







## **COURSES OF READING AND STUDY**





**THE NEW  
INTERNATIONAL  
ENCYCLOPÆDIA**

**SECOND EDITION**

**COURSES OF  
READING AND STUDY**

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# Preface

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THE purpose of the present volume, as its name suggests, is to offer help towards self-instruction in the various arts and sciences, utilizing the *New International Encyclopædia* as a general text-book. There is little need to emphasize in this place the rôle of popular educator played by a work like the Encyclopædia. This has been long recognized; and, from a mere work of reference consulted at odd moments for fragments of information, the modern Encyclopædia has become in thousands of homes a source of common culture, the basis of a thorough training in the principles and facts of History, Law, Literature, the Fine Arts, Religion, Biology, Engineering, Physics, Chemistry, or Agriculture. Especially where access to large libraries is difficult or impossible, its value is apparent. In every department of human knowledge, it speaks with a copiousness unequalled in the average text-book and a degree of authority attainable only when every department, and subdivision of a department, is covered by an acknowledged specialist in the field.

A glance at any chapter in the book will show the method pursued. The aim has been to make every chapter a complete summary of the subject with which it deals by arranging the material as the reader or student would find it arranged in a systematic treatise on the subject. The amount of text in each chapter has necessarily been reduced to a minimum, only so much being given as is essential to trace the connection between the successive groups of titles. But, when it is considered that every title in every group represents from two or three hundred to fifteen thousand words of text, the completeness of treatment will be realized.

Within the chapter the material has been divided and subdivided in such a manner as to facilitate study on special topics. If the reader, for instance, desires to make himself particularly well acquainted with a certain period in American History, he need but turn to the proper section in Chapter I., where the subject of American History is outlined in five sub-headings with as many groups of titles; and at the end of the section on American History he will find a list of authorities in whose works he may carry on supplementary reading to any extent. In the same manner, a person interested in the ceremonial or hymnology or clerical vestments of the Roman Catholic Church will find these topics treated in related groups of titles as a section in the chapter on Religion. Under Chemistry one may study the entire subject, carefully outlined for such a purpose, or may concentrate on the acids or the salts or the fats. In every chapter, the technical exposition is supplemented by comprehensive lists of biography wherein the historical aspect of the subject finds complete treatment.

In quoting titles in the lists, the form given is that, of course, which appears in the Encyclopædia; as, CRUELTY TO CHILDREN, PREVENTION OF; or, MACHINERY, ECONOMIC EFFECTS OF. Where reference is made to a long article, the particular section is indicated; as, "See section *The Renaissance* under SCULPTURE," in which case, the reader will turn to Sculpture in the Encyclopædia. In the biographical

titles, the full Christian name, or the corresponding initials, is given as a rule ; as ADAMS, SAMUEL ; ADAMS, H., KIPLING. The alphabetic arrangement of titles in the Encyclopædia makes reference to volume and page obviously superfluous.

It is in its orderly marshalling of the material contained in the Encyclopædia that we believe the value of this book consists. It is quite unlikely that the average reader, left to his own guidance, will plan his course in such a manner as to produce the fullest results with the least waste of time. Where the subject is unfamiliar, he is as apt at the start to hit upon the middle of it as upon the beginning, and, in passing from article to article, there is always the danger of his missing the logical sequence of topics. A mere index would here be useless. What is necessary is a carefully planned outline that shall lead the reader, step by step, from elementary principles to the most specialized treatment. Such a guide this Outline aims to be.

The preparation of this volume, carried on under the supervision of the Editors, has been in the direct charge of Mr. SIMEON STRUNSKY, of the staff of the *New International Encyclopædia*, and the supervision of the revision for the second edition under the charge of Mr. IRWIN SCOFIELD GUERNSEY.

—THE EDITORS.

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# Chapter 1. History

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**H**ISTORY, which we may define as the record of man's life on earth and the sum of his achievements, would include in its broadest aspect the entire story of human development from Palæolithic man to the present day. As a matter of convenience, however, in this book we shall leave the beginnings of associated human life to be treated under the heading of Anthropology and Ethnology, where, too, will be found the material for the stories of those peoples and tribes which to the present day have remained without the pale of our civilization. Here we shall take up the narrative at a point in time when we first catch a glimpse of the nations whose culture, evolved during thousands of years, and passed on from hand to hand, has become the heritage of the present day. The traditional division into Ancient, Mediæval, and Modern history is followed, and in accordance with custom the account begins with the nations of the Mesopotamian region, and passes on through Persia and the empire of Alexander into Rome, where also the course of Egyptian, Jewish, Phœnician, and Greek history, taken up in turn, leads us. With Rome, Ancient history ends. India, China, and Japan, though their history goes back to a past coeval with the period we call ancient, are treated apart because of their far less intimate connection with the civilization of Europe, wherein our interest is centered. Mediæval history takes up the story at the fall of Rome, traces the amalgamation of the old world with the new, the growth of the Church, the rise of States, and the transition, through inward development and outward contact with Asia and America, to modern times. There European history becomes largely the story of nations and their conflicts. One by one due treatment is accorded them, the field widening as Australia, Africa, and Asia come within the scope of European interests. The record ends with a section on the history of the United States outlined with greater detail than the account of other lands.

First some conception of the methodology of historical writing and a bird's eye view of the history of the world may be useful, for which see:

History  
Asia  
Europe

Africa  
America  
Australia

## A. Ancient History

### 1. BABYLONIA, ELAM, AND ASSYRIA.

Archæological research has carried back the origin of Sumerian and Akkadian civilization to the fifth millennium B. C., given us a fairly continuous history of Babylonia, Elam, and

Assyria, and revealed something of the literature, science, art, laws, and social life of these countries. Babylonia was ruled at times by Gutians, Elamites, Kassites, Assyrians, and Chaldeans, but always exercised a power-



ful cultural influence. The Assyrians established an empire that finally included Elam, Mesopotamia, Syria, and Egypt. A part of it fell to the Chaldean kingdom, which was conquered by Cyrus in 539 B. C. See:

(a) For the Land:

Mesopotamia  
Euphrates  
Tigris  
Babylonia  
Assyria  
Arrapachitis  
Adiabene  
Shinar  
Elam

(b) For the Cities:

Nippur  
Babylon  
Calah  
Ur  
Erech  
Nineveh  
Assar  
Khorsabad

(c) For the Kings:

Sargon  
Hammurapi  
Shalmaneser  
Tiglath-pileser  
Asurnazirpal  
Sennacherib  
Esarhaddon  
Sardanapalus  
Nabonassar  
Nabopolassar  
Nebuchadnezzar  
Belshazzar  
Cyrus

(d) For the People, Religion, and  
Language:  
Sumerian Language

Chaldeans

Kassites

Amorites

Mitannians

Merodach

Ishtar

Semitic Languages

Babylonian Art

Assyrian Art

Cuneiform Inscriptions

(e) For the Historians and Investigators:

Botta, P. E.  
Delitzsch, F.  
Layard, A. H.  
Meyer, E.  
Oppert, J.  
Rassam, H.  
Rawlinson, H. C.  
Sayce, A. H.  
Schrader, E.  
Smith, G.  
Winckler, H.

2. EGYPT.

From the monuments it is evident that the Egyptian civilization was in its origin independent of the Babylonian and goes back to as early an antiquity. From primitive times when the land was divided into two sections, the Delta and the South, we pass through many dynasties of pyramid and temple building kings to a time of subjugation by foreign invaders, of conquests in Palestine and Asia Minor, of decline, and of reduction by the Persians, by Alexander of Macedon, and by Rome. A cheerful people, influenced greatly by their priests, submissive to their kings, worshiping many gods and animals, they left behind them massive structures of which we have not yet the secret. Their

priests read the stars and knew geometry, speculated on the soul, and probably passed on to the Phœnicians the alphabet which was to be ours.

(?— B. C. 30) See:

(a) For the Land:

Egypt  
Nile  
Delta  
Nubia  
Ethiopia  
Libya  
Suez Canal

(b) For the Cities and Monuments:

Memphis  
Tanis  
Thebes  
Karnak  
Luxor  
Ramesseum  
Pyramid  
Rosetta Stone

(c) For the Kings:

Menes  
Cheops  
Chephren  
Amenemhat  
Usertesen  
Amasis  
Amenophis  
Thothmes  
Hatasu  
Rameses  
Psammetichus  
Necho  
Amasis II  
Ptolemy  
Cleopatra

(d) For the People, Religion, Language, and Culture:

Egypt  
Hamites

Hyksos

Rê

Horus

Osiris

Thoth

Athor

Ammon

Apis

Set

Isis

Nephthys

Anubis

Hieroglyphics

Egyptian Art

Egyptian Music

(e) For the Historians and Investigators:

Egyptology

Breasted, J. H.

Brugsch, H. K.

Champollion, J. F.

Lenormant, C.

Lepsius, K. R.

Manetho

Mariette, A. E.

Maspero, G. C. C.

Naville, E. H.

Petrie, W. M. F.

Renouf, P.

Rougé, O. C. E.

Sayce, A. H.

Wilkinson, J. G.

### 3. PHŒNICIA AND ASIA MINOR.

What is now Syria and part of Asia Minor was in the earliest times debatable ground between Egypt and the Mesopotamian monarchies. On the Palestinian coast the Phœnicians, with little territory, developed a splendid industry and commerce and in their ships carried the seeds of Babylonian and Egyptian civilization over the Mediterranean basin. Later, when the

Hyksos were invading Egypt, a people known as the Hittites appear, stout fighters who render a good account of themselves against the Assyrians and Egyptians. Their homes were in Northern Syria and in Eastern Asia Minor, but about B. C. 700 they disappeared, leaving little trace behind them. See:

(a) For the Phœnicians:

Phœnicia  
Sidon  
Tyre  
Acre  
Byblos  
Cyprus  
Carthage  
Hiram  
Melkarth  
Astarte  
Phœnician Art  
Amarna Letters

(b) For the Hittites:

Hittites  
Syria  
Boghaz-Keui  
Eyuk  
Mitannians  
Cappadocia  
Carchemish  
Marash  
Hamath

#### 4. THE JEWS.

The Jews form the third in the group of peoples lying between Egypt and Babylonia and affected by the influence of both. The Hebrews, a Semitic tribe of nomads, after wandering through the land of Canaan, enter the land of Goshen, a territory belonging to Egypt, are there held in bondage, and, hammered into a nation by

persecution, escape, conquering for themselves the land of Canaan and passing thereby from the nomad into the agricultural stage. See:

Jews  
Palestine  
Goshen  
Semitic Languages  
Abraham  
Isaac  
Jacob  
Esau  
Amarna Letters  
Exodus  
Moses  
Aaron  
Joshua  
Canaan  
Simeon  
Judah  
Levi  
Gad  
Naphtali  
Issachar  
Dan  
Zebulun  
Ephraim  
Benjamin

Ruled by warrior leaders for a long period, the people finally obtain a king, but after a hundred years the nation breaks into two, the northern, Israel, falling to Assyria, the southern, Judah, 150 years later to Babylonia. The Babylonian exiles return and re-establish the Jewish state in the form of a theocracy based on a purified Yahwe worship. See:

Jews  
Saul  
David  
Jerusalem  
Solomon

Judah  
 Jeroboam  
 Joash  
 Abimelech  
 Jehosaphat  
 Ahab  
 Josiah  
 Hezekiah  
 Samaritans  
 Babylonia  
 Nehemiah  
 Ezra  
 Cyrus  
 Amorites  
 Philistines  
 Aramæans  
 Ammon  
 Moab  
 Edom  
 Judges, Book of  
 Kings, Books of

The reëstablished State passes from the suzerainty of Persia to that of Macedonia, the Seleucid kings of Syria, and Rome, rising against whom, Jerusalem is taken (A. D. 70), the Temple destroyed, and the greater part of the nation scattered over the Roman world. The insurrection of Bar-Kokba in the second century is the last forcible assertion of the national spirit. The Jews now enter upon their historic rôle of wanderers, subject alternately to persecution and favor at the hands of rulers and peoples, and held together as a folk by the Law and the Talmud. See:

(a) Jews

Babylonish Captivity  
 Antiochus  
 Maccabees  
 Herod  
 Sadducees

Pharisees  
 Zealot  
 Essenes  
 Zadokites  
 Messiah  
 Bar-Kokba  
 Spain  
 Crusades  
 Anti-Semitism  
 Zionist Movement

(b) For the Law, Language, Literature, and Science:

Bible  
 Pentateuch  
 Talmud  
 Gemara  
 Mishna  
 Cabbala  
 Halacha  
 Haggada  
 Midrash  
 Maimonides  
 Yiddish

(c) For the Historians:

Josephus, Flavius  
 Ewald, G. H.  
 Wellhausen, J.  
 Renan, E.  
 Graetz, H.

5. PERSIA.

In northeastern Iran, a people, the Medians, shake off the yoke of Assyria in the eighth century B. C. and soon attain power over their former masters, but fall themselves under the domination of the Persians and Cyrus, who brings under his sway all of Mesopotamia and Palestine. Under his successors Persia becomes the greatest empire of pre-Alexandrian times, spreads to the Mediterranean, and enters Egypt, but fights vainly against the Greeks and is conquered by the young

hero of Macedon. The empire falls apart, the heart of it, Persia proper, passing in turn to the Parthians, Arabs, Turks, Mongols, and Turks again, till it remains what it is at the present day, a piece in the game between England and Russia in Asia. See:

(a) For the Land and the People:

Iran  
Media  
Persia  
Asia Minor  
Bactria  
Parthia  
Armenia  
Susa  
Persepolis  
Ctesiphon  
Ecbatana

(b) For the Dynasties and Kings:

Achæmenidae  
Seleucidae  
Arsacidae  
Sassanidae  
Abbasides  
Samani and Dilemi  
Ghaznevdes  
Ghuri  
Seljuks  
Astyages  
Cyrus  
Cambyses  
Darius  
Xerxes  
Artaxerxes  
Khosru  
Hulaku Khan  
Timur  
Abbas I.  
Nadir Shah

(c) For the Culture:

Persian Art

Persian Language  
Persian Literature

6. GREECE.

The seeds of culture brought to Greece by the Phœnicians from Babylon, Egypt, and Asia Minor, developed into a new civilization, the highest in many respects the world has as yet seen, which influenced mightily the history of future ages. The legendary accounts, in the tales of heroes and gods, probably reflect historical conditions. See:

Mythology  
Danaüs  
Cadmus  
Hercules  
Theseus  
Minos  
Argonauts  
Trojan War  
Agamemnon  
Ulysses  
Achilles

Greek history begins with a succession of great migrations from the mainland eastward towards Asia Minor. When authentic history begins, Greece appears as an agglomeration of small independent states, in a state of transition from the monarchical form of government into tyrannies, oligarchies, and democracies. See:

(a) For the Land:

Greece  
Asia Minor  
Crete  
  
Thessaly  
Bœotia  
Epirus  
Attica  
Peloponnesus

Eubœa  
 Lesbos  
 Chios  
 Ithaca  
 Pydnus  
 Olympus  
 Delos

(b) For the Cities:

Athens  
 Sparta  
 Thebes  
 Mycenæ  
 Tiryns  
 Argos  
 Corinth

(c) For the People:

Archæology, II  
 Hellenes  
 Danai  
 Dorians  
 Ionians  
 Æolians  
 Achæans

(d) For the Men:

Lycurgus  
 Solon  
 Pisistratus  
 Clisthenes

Greece  
 Athens  
 Miltiades  
 Marathon  
 Themistocles  
 Salamis  
 Thermopylæ  
 Aristides  
 Leonidas  
 Ephialtes  
 Pericles  
 Conon  
 Nicias  
 Sparta  
 Syracuse  
 Lysander  
 Agesilaus  
 Antalcidas  
 Pausanias  
 Epaminondas  
 Pelopidas  
 Mantinea  
 Leuctra  
 Macedon  
 Philip II  
 Demosthenes  
 Æschines  
 Alexander the Great  
 Chæronea  
 Antipater  
 Demetrius Poliorcetes  
 Ætolian League  
 Achæan League  
 Philopœmen  
 Pydna  
 Cynoscephalæ

The Greeks, after a long, successful struggle against Persia, won national greatness. Democratic Athens first takes the lead among the Greek city states and for a half century plays a brilliant part, then succumbs to Sparta, which in turn falls before Thebes. Disunion brings Greece under the sway of Macedon, whose young king, Alexander the Great, conquers Persia and Egypt and spreads the Hellenic culture in his new realm. Greece proper is ruled by Macedon till it falls with Macedon under the power of Rome. See:

In the Greek city states the problems of democracy were well worked out, and politics became an exact science. The principles of democracy were carried over the basin of the Mediterranean and the Black Sea, wherever the Greeks, the successors of the Phœnicians as traders and colonizers, went. See:

**(a) For Greek Government:**

Monarchy  
 Tyrant  
 Democracy  
 Aristocracy  
 Despot  
 Ecclesia  
 Areopagus  
 Ostracism  
 Boule  
 Ephori  
 Archon  
 Solon  
 Lycurgus  
 Lysander

**(b) For the Greek Colonies:**

Ionia  
 Mitylene  
 Ephesus  
 Halicarnassus  
 Chalcidice  
 Colchis  
 Chersonesus  
 Cyrene  
 Sicily  
 Magna Græcia  
 Marseilles

Over all the Greek world the Hellenic culture prevailed as in the home country. See:

Architecture, Greece  
 Greek Language  
 Greek Literature  
 Greek Music  
 Greek Art  
 Greek Philosophy

The Greek religion passed from an unrestrained polytheism into an anticipation of monotheism on the part of the select few, into gross superstition on the part of the many. See:

Olympus  
 Pantheon

Jupiter

Juno

Apollo

Mercury

Vulcan

Ceres

Venus

Diana

Mars

Minerva

Neptune

Pluto

Greek Religion

Greek Festivals

Games

Olympic Games

Mysteries

**For the Historians:**

Herodotus

Thucydides

Xenophon

Plutarch

Polybius

Dio Cassius

Dionysius of Halicarnassus

Arrianus

Theopompus

Diodorus Siculus

Curtius, E.

Finlay, G.

Grote, G.

Schliemann, H.

**7. ROME.**

Greek civilization was imposed on the peoples of Europe, Northern Africa, and Western Asia by the armies of Rome, whose origin goes back to a settlement of Latin outlaws and shepherds on one of the seven hills south of the Tiber. A legendary kingdom gives way, about the beginning of the sixth century B. C., to a republican

form of government. A long contest between privileged and non-privileged classes results in the elaboration of a splendidly efficient system of municipal government. See:

(a) For the Land and the People:

Rome  
Italy  
Latium  
Italic Languages  
Latini  
Etruria  
Samnites

(b) For the Cities:

Rome  
Alba Longa  
Veii  
Tarentum  
Capua  
Naples  
Brindisi  
Pompeii  
Herculaneum

(c) For the Kingship and the Struggle between Classes:

Romulus  
Numa Pompilius  
Tarquinius  
Comitia  
Patrician  
Plebeians  
Consul  
Tribune  
Prætor  
Censor  
Ædiles  
Senate  
Decemviri  
Hortensius  
Licinian Rogations

conquest and by means of her splendid military art and unscrupulous diplomacy makes herself mistress of Latium, of Italy, and, after a struggle with Carthage, with Macedonia, and with Syria, of the Mediterranean basin. Unchecked power, however, brings corruption within the State, republican institutions tend to become empty forms, factional strife breaks out, the Senate rules for a while and then succumbs to the ambition of masterful politicians; in the conflict of parties the Republic meets its end. See:

Gaul  
Camillus  
Pyrrhus  
Carthage  
Punic Wars  
Hamilcar  
Hasdrubal  
Hannibal  
Hispania  
Cannæ  
Zama  
Scipio  
Macedonia  
Antiochus  
Gracchus  
Agrarian Laws  
Jugurtha  
Marius  
Sulla  
Pompeius  
Mithridates  
Cicero  
Catiline  
Cæsar  
Cassius  
Brutus  
Crassus  
Antonius  
Cleopatra  
Actium

With her internal problems settled, Rome enters upon a career of foreign



The Roman Empire, established by Augustus before the beginning of the present era, attained its greatest extent in the early years of the second century of that era and entered on its decline towards the end of the same century. At its height it embraced within its limits the classic world. Peace, excellent means of communication, and an unrivalled administrative system brought the different parts of the Empire close together and facilitated the spread of Greek culture and later of Christianity. The decline of the Empire, due to the decay of old age and the onset of the barbarian tribes of Northern Europe, is arrested by the reforms of Diocletian and of his successor Constantine the Great, who, in the beginning of the fourth century, makes Christianity the State religion. See:

Augustus  
Tiberius  
Caligula  
Claudius  
Nero  
Vespasian  
Titus  
Domitian  
Trajan  
Hadrian  
Antoninus Pius  
Aurelius  
Commodus  
Severus, Septimius  
Caracalla  
Severus, Alexander  
Aurelianus  
Diocletian  
Prætorian Guard  
Constantine the Great  
Christianity  
After Constantine the decline is pre-

cipitate. The ancient Roman prowess is gone, and the defence of the Empire is entrusted to barbarian mercenaries; the task of government becomes too heavy for one man, and the Empire is divided in two. The wave of barbarian migration breaks with full force upon the Western Empire, and the last emperor of Latin Rome is dethroned in 476. See:

Migration  
Parthia  
Julian  
Theodosius  
Stilicho  
Alaric  
Attila  
Huns  
Goths  
Vandals  
Burgundians  
Odoacer  
Ravenna  
Honorius  
Augustulus  
Aëtius

The Romans were preëminent for their political genius; their literature, in part, their philosophy, and their art were copies of the Greek, and the general culture at the time of the Empire's zenith was Hellenistic; their gods, too, were largely borrowed or adapted from the Greek pantheon; but in administration and law they were unexampled innovators and in these fields they influenced subsequent European civilization mightily. See:

(a) For the Religion:

Roman Religion  
Jupiter  
Janus  
Mars

Quirinus

Vesta

Auguries and Auspices

Flamens

Lupercalia

Salii

(b) For the Language and Culture:

Italic Languages

Latin Language

Latin Literature

Roman Art

Philosophy

(c) For Administration and Law:

Civil Law

Justinian

Twelve Tables

Jus Gentium

Municipality

Papinianus

Paulus

Pandects

(d) For the Historians:

Ammianus Marcellinus

Annals

Appianus

Eutropius

Ferrero, G.

Gibbon, E.

Ihne, W.

Livy

Merivale, C.

Mommsen, T.

Niebuhr, B. G.

Sallust

Suetonius

Tacitus

## B. Mediæval History

1. The East Roman or Byzantine Empire continued to exist for a thousand years. Within the limits of the Western Empire the Germanic tribes settled as masters, and from their gradual amalgamation with the conquered Roman provincials date the beginnings of the modern peoples of Europe. The most powerful of the barbarian kingdoms, that of the Franks, attained imperial extension under Charles the Great, who, by his alliance with the Pope, established the connection between Empire and Church, which was to become one of the most powerful determinants of events in the Middle Ages. See:

(a) For the Migrations:

Migration

Britannia

Angles

Saxons

Jutes

Gaul

Burgundians

Franks

Hispania

Suevi

Vandals

Italy

Goths

Theodoric

Lombards

Saracens

(b) For the East Roman Empire:

Byzantine Empire

Justinian

Belisarius

Narses

**(c) For the Frankish Empire:**

Clovis  
 Merovingians  
 Carolingians  
 Brunhilda  
 Fredegunda  
 Charles Martel  
 Pepin the Short  
 Donation of Pepin  
 Charles the Great  
 Papal States  
 Salic Law

2. On the death of Charles the Great the Frankish Empire falls apart. Two great kingdoms arise, France and Germany. The Germans make their power supreme in Central Europe and in Italy, and a German king is crowned Holy Roman Emperor, reviving the connection between Church and State established by Charles the Great. A second Teuton stock, the Northmen, appear as conquerors in France, England, Italy, and Russia. The growth of nations proceeds rapidly, and from the relations between conqueror and conquered develops Feudalism. The young nations are brought into conflict with the growing power of the Church, which, under the leadership of the Bishop of Rome, seeks to raise the ecclesiastical power above the secular. The break-up of the Mediæval ages begins with the Crusades. See:

**(a) For the Growth of Nations:**

Franks  
 Verdun, Treaty of  
 France  
 Neustria  
 Germany  
 Austrasia  
 Franconia  
 Swabia

Alemanni  
 Otho the Great  
 Holy Roman Empire  
 Normans  
 Normandy  
 Varangians  
 England  
 William the Conqueror  
 Italy  
 Sicily  
 Guiscard  
 Russia

**(b) For Mediæval Society:**

Feudalism  
 Feud  
 Livery  
 Homage  
 Knight  
 Chivalry  
 Esquire  
 Heraldry  
 Serf  
 Ordeal  
 Truce of God  
 Compurgation

**(c) For the Struggle between Church and State:**

Gregory VII  
 Investiture  
 Hohenstaufen  
 Guelphs and Ghibellines  
 Henry IV of Germany  
 Henry V of Germany  
 Papacy  
 Innocent III  
 Philip II of France  
 Philip IV of France  
 John of England  
 Henry II of England  
 Frederick I Barbarossa  
 Frederick II of Germany

**(d) For the Crusades:**

Crusades

Papacy  
 Hospitalers  
 Templars  
 Teutonic Knights  
 Peter the Hermit  
 Urban II  
 Godfrey de Bouillon  
 Bohemund  
 Tancred  
 Baldwin  
 Antioch  
 Richard I of England  
 Saladin  
 Venice  
 Dandolo  
 Louis IX of France  
 Latin Kingdom of Jerusalem

3. The Crusades were followed by a great increase in the commerce of Western Europe and the rise of an influential burgher class, with whose aid the kings succeeded in making themselves independent of the feudal nobility. With the growth of centralized kingdoms the power of the Papacy declines. Contact with the East and the ancient world stimulated the European mind, and the Revival of Learning, the succession of great geographical and astronomical discoveries, and the invention of gunpowder and printing hasten the transition from the Middle Ages to modern times. The uniformity of European society, characteristic of the Middle Ages, is broken up by the Reformation. See:

(a) For Commerce, Discoveries, and Inventions:

Hanseatic League  
 Gunpowder  
 Printing  
 Copernicus  
 Columbus

Gama, Vasco da  
 Venice  
 Genoa  
 Henry the Navigator  
 Africa  
 America

(b) For the Decline of the Papacy:

Boniface VIII  
 Avignon  
 Schism, Great  
 Constance, Council of  
 Basel, Council of

(c) For the Revival of Learning and the Renaissance:

Petrarch  
 Bracciolini  
 Guarino  
 Poliziano  
 Lorenzo de' Medici  
 Erasmus  
 Colet  
 Grocyn  
 Linacre  
 More, Thomas  
 Reuchlin  
 Hutten, Ulrich von  
 Epistolæ Obscurorum Virorum  
 Renaissance Art

(d) For the Reformation:

Reformation  
 Wiclif  
 Huss  
 Luther  
 Charles V  
 Augsburg Confession  
 Melancthon  
 Schmalkaldic League  
 Zwingli  
 Calvin  
 Huguenots  
 Henry VIII of England  
 Wishart  
 Knox

Counter-Reformation  
Trent, Council of  
Thirty Years' War

For the Historians:

Creighton, M.  
Denifle, F. H.  
Emerton, E.  
Fisher, G. P.

Fleury, Claude  
Gieseler, J. K.  
Hallam, H.  
Harnack, Adolf  
Hefele, K. J.  
Lea, H. C.  
Neander, J. A.  
Pastor, L.

## C. Modern History

At the opening of the modern era the process of State formation in Europe had resulted in the establishment of firmly centralized nations in England, France, and Spain. Germany and Italy, on the contrary, were disunited, and destined so to remain till the later years of the nineteenth century. The conflicts of States and nationalities is one of the great features of modern times; till 1648 religion is a fruitful cause of external warfare and civil strife; after 1648 wars are fought on political and commercial grounds. The disappearance of a common Church and of Latin as the common vehicle of communication among the higher classes tended to intensify the differentiation of national characteristics. The burgher class, which had begun to assert itself in the period after the Crusades, rose to full recognition in the life of the State and in turn was forced to render recognition, after the French Revolution, to the lowest classes in the State, artisans and peasants. The Church loses control over the temporal affairs of its members, and even in the spiritual field its authority is subordinated to that of the State. Life takes on a predominantly secular tinge; science broadens the intellectual horizon,

and commerce and colonization bring the non-European part of the Eastern Hemisphere within the sphere of European influence. The history of modern times is best studied in the history of the various nations.

### 1. ENGLAND.

The Britannia of the Romans is overrun in the age of migrations by Teutonic tribes from Jutland and the northwest of Germany, who, receiving a new infusion of kindred blood from the Danes, are conquered in the eleventh century by a more remote kinsfolk, the Normans—Gallicized Teutons from France. Saxons and Normans are blended into one before 1400, by which time a constitutional system of government, worked out in the course of long conflicts between rulers and subjects, is in force, based on the supreme legislative authority of a Parliament, representing the different estates. Wales and Ireland have been subdued, and Scotland has ceased to be a dangerous rival. Feudalism, never so strong in England as on the Continent, is practically destroyed during the Wars of the Roses in the fifteenth century, and the modern era may be dated from the accession of the Tudors in 1485. See:

England  
 Britannia  
 Anglo-Saxons  
 Heptarchy  
 Alfred  
 Edward the Confessor  
 Canute  
 Harold  
 Witenagemot  
 William the Conqueror  
 Hastings, Battle of  
 Hereward  
 Domesday Book  
 William II  
 Henry I  
 Stephen  
 Plantagenet  
 Henry II  
 Becket  
 Ireland  
 English Pale  
 Richard I  
 John  
 Magna Charta  
 Oxford, Provisions of  
 Montfort, Simon de  
 Edward I  
 Parliament  
 Wales  
 Llewellyn ap Griffith  
 Scotland  
 Wallace  
 Bruce  
 Bannockburn  
 Edward II  
 Mortimer, Roger de  
 Edward III  
 Hundred Years' War  
 Crécy  
 Poitiers  
 Black Death  
 Richard II  
 Tyler's Rebellion  
 Ball, John

Wiclif  
 Provisors, Statute of  
 Præmunire  
 Mortmain, Statutes of  
 Lancaster, House of  
 Henry IV  
 Agincourt  
 Henry VI  
 York, House of  
 Margaret of Anjou  
 Cade, Jack  
 Roses, Wars of the  
 Edward IV  
 Warwick, Earl of  
 Richard III  
 Tudor

Under the Tudors the power of Parliament greatly declined. The Reformation, initiated by Henry VIII, soon spread beyond the limits the King would set to it, and England became Protestant. Under Elizabeth it was forced to contend against Spain, the champion of Catholicism. With the defeat of Spain, England enters on her career as ruler of the seas and begins the work of founding a new English-speaking nation across the Atlantic. The death of Elizabeth, the last of the Tudors, gives England and Scotland a common sovereign. A revived Parliament asserts its rights successfully against the absolutism of the Stuarts, dethrones them, recalls them, and drives them as enemies of Protestantism once more from the throne, bestowing the crown upon a prince of Dutch blood. The crowns of England and Scotland are united. On the Continent, England takes a leading part in the overthrow of Louis XIV of France and comes out of the struggle more powerful than ever upon the seas. See:

Henry VII

Parliament  
 Star Chamber  
 Benevolence  
 Henry VIII  
 Boleyn, Anne  
 Wolsey, Cardinal  
 Cromwell, Thomas  
 Reformation  
 Cranmer  
 Edward VI  
 Mary I  
 Ridley  
 Latimer  
 Elizabeth  
 Supremacy  
 Mary Stuart  
 Burleigh  
 Walsingham  
 Leicester  
 Essex  
 Armada  
 Drake  
 Howard  
 Stuart  
 James I  
 Charles I  
 Petition of Rights  
 Ship-Money  
 Strafford, Earl of  
 Laud  
 Long Parliament  
 Grand Remonstrance  
 Five Members  
 Pym  
 Eliot  
 Hampden  
 Cromwell, Oliver  
 Vane, Henry  
 Blake  
 Fairfax  
 Ireton  
 Scotland  
 Covenants  
 Presbyterianism

Montrose, Earl of  
 Charles II  
 Clarendon, Earl of  
 Cabal  
 Test Acts  
 Oates, Titus  
 Shaftesbury, Earl of  
 James II  
 Halifax, Earl of  
 William III  
 Mary II  
 Anne  
 Succession Wars (*Spanish*)  
 Utrecht, Treaty of  
 Marlborough, Duke of  
 Bolingbroke  
 Harley  
 Sacheverell

With the accession of the House of Hanover, the supremacy of Parliament is firmly established; cabinet government is developed, and the rule of party is the order—by the Whigs, roughly speaking, to the French Revolution, by the Tories to 1832, by the two or their successors since then, in comparatively rapid alternation. France is defeated and deprived of her Indian and American possessions, but almost immediately England suffers an irreparable loss in the defection of the thirteen colonies. Partial compensation, however, is found in India, where English adventurers build up a new empire. After the French Revolution and the Napoleonic Wars, comes strife between the advocates of reaction and the rising forces of democracy, stimulated by the great industrial revolution. The latter win in 1832, and the subsequent history of England is one of democratic progress within, of conquest and commercial expansion abroad. See:

United Kingdom  
Whig and Tory  
George IV  
Cabinet  
South Sea Company  
Walpole, Robert  
Newcastle, Duke of  
Chatham, Earl of  
Seven Years' War  
Bute, Earl of  
Grenville  
Townshend  
Wilkes, John  
North, Lord  
Fox, Charles James  
Pitt, William  
Burke, Edmund  
Sheridan, R. B.  
Trafalgar  
Nelson  
Wellington  
Peninsular War  
Canning  
India  
Clive  
Hastings, Warren  
Wellesley, Marquis  
Cornwallis, Lord  
Dupleix  
William IV  
Peterloo Massacre  
Trade Unions  
Russel, Lord John  
Grey, Earl (1st, 2d and 3d)  
Victoria  
Corn Laws  
Peel, Robert  
Cobden, John  
Bright, John  
Palmerston, Lord  
Derby, Earl  
Disraeli  
Gladstone  
Salisbury, Marquis of

Rosebery, Earl of  
Chamberlain, Joseph  
Balfour, Arthur  
Beresford, Lord C.  
Campbell-Bannerman  
Law, A. Bonar  
Morley, Viscount  
Ireland  
Tyrconnel  
Stewart, Robert  
Home Rule  
Roman Catholic Emancipation  
O'Connell, Daniel  
Irish Land Laws  
Fenian Society  
Redmond, J. E.  
Parnell, Charles Stewart  
Australia  
Canada  
Imperial Federation  
Edward VII  
South African War  
French, Sir J. W.  
Union of South Africa  
War in Europe  
Asquith, H. H.  
Lloyd-George, D.  
Kitchener of Khartum  
George V  
Churchill, W. S.  
Curzon, Earl

For the Historians:

Acton, J. E. E. D.  
Bury, J. B.  
Clarendon, Lord  
Elphinstone, M.  
Firth, C. H.  
Freeman, E. A.  
Froude, J. A.  
Fyffe, C. A.  
Gairdner, J.  
Gardiner, S. R.  
Geoffrey of Monmouth



Gildas  
 Giraldus de Barri  
 Green, J. R.  
 Gross, C.  
 Gwatkin, H. M.  
 Hallam, H.  
 Holinshed, R.  
 Kinglake, A. W.  
 Kingsford, W.  
 Lappenberg, J. M.  
 Lecky, W. E. H.  
 Lingard, J.  
 Macaulay, T. B.  
 McCarthy, Justin  
 Maitland, F. W.  
 Napier, W. F. P.  
 Oman, C. W. C.  
 Palgrave, F.  
 Paris, Matthew  
 Rose, J. H.  
 Seebohm, F.  
 Stubbs, W.  
 Turner, Sharon  
 Walpole, Spencer  
 William of Malmesbury

## 2. FRANCE.

Upon the dissolution of the Frankish Empire in the ninth century, descendants of Charles the Great continue to rule over the land of the Western Franks with a population predominantly Celtic and a language derived from the Latin. This is the beginning of France. The weak Carolingians are replaced by the energetic house of Capet, under which the unification of the country is carried on by such able rulers as Philip II, Louis IX, and Philip IV. The Hundred Years' War is disastrous to the kingdom, but its recovery is rapid under Charles VII and his son, Louis XI, who leave the

power of the crown firmly established. Religious wars in the sixteenth century become a factor for anarchy, but feudalism is definitely crushed by Richelieu, and absolutism is established by Louis XIV, under whom France is for fifty years the overweening power in Europe. Absolutism breaks down under Louis XIV's unworthy successors, and the entire ancient fabric of society is swept away by the French Revolution. See:

France  
 Brittany  
 Normandy  
 Burgundy  
 Flanders  
 Aquitania  
 Anjou  
 Navarre  
 Franks  
 Carolingians  
 Verdun, Treaty of  
 Capetian Dynasty  
 Louis VII  
 Philip II, Augustus  
 Louis IX  
 Philip IV, the Fair  
 Valois, House of  
 Hundred Years' War  
 Crécy  
 Poitiers  
 John II  
 Jacquerie  
 Charles VI  
 Agincourt  
 Du Guesclin  
 Dunois  
 Joan of Arc  
 Charles VII  
 Louis XI  
 Charles the Bold  
 Charles VIII

Louis XII  
 Francis I  
 Henry II  
 Huguenots  
 Catharine de' Medici  
 Guise  
 Condé  
 Coligny  
 Bartholomew's, Massacre of Saint  
 Charles IX  
 Henry III  
 Politiques  
 Henry IV  
 Nantes, Edict of  
 Sully, Duke de  
 Louis XIII  
 Richelieu  
 Westphalia, Peace of  
 Mazarin  
 Maintenon, Marquise de  
 Louis XIV  
 Fronde  
 Parlement  
 Colbert  
 Louvois  
 Turenne  
 Vendôme, Duke de  
 Luxembourg, Duke of  
 Villars  
 Camisards  
 Succession Wars  
 Orleans, Philippe, Duke of  
 Dubois  
 Louis XV  
 Seven Years' War  
 Pompadour, Marquise de  
 Du Barry, Countess  
 Louis XVI  
 Turgot  
 Necker  
 Farmers-General  
 States-General  
 The abolition of feudalism by the  
 French National Assembly is followed

by the overthrow of the monarchy.  
 Assailed by the rulers of Europe,  
 France retaliates, and its conquering  
 armies carry the gospel of democracy  
 over the Continent. Under Napoleon,  
 France dominates Europe until, de-  
 feated by a rising of the European  
 peoples, it is compelled to take back its  
 Bourbon kings. Reaction struggles  
 with the advancing ideals of political  
 and social revolution, and the country  
 witnesses within the century the over-  
 throw of three dynasties and the estab-  
 lishment of two republics. Under  
 Napoleon III, France regains for a  
 brief period its ascendancy in Euro-  
 pean politics, but suffers overwhelming  
 defeat at the hands of a new-created  
 Germany. Her latest history has to  
 do with the slow grounding of repub-  
 lican principles, the adjustment of rela-  
 tions between Church and State and the  
 great war which began in 1914. See:

French Revolution  
 Assembly, National  
 Mirabeau  
 Marie Antoinette  
 Bastille  
 National Guard  
 Lafayette  
 Bailly  
 Jacobins  
 Feuillants  
 Cordeliers  
 Barnave  
 Pétion  
 Pillnitz  
 Valmy  
 Jemappes  
 Dumouriez  
 Convention, National  
 Girondists  
 Brissot

Roland de la Platière  
 Vergniaud  
 Montagnardes  
 Marat  
 Danton  
 Billaud-Varennes  
 Carnot  
 Callot d'Herbois  
 Robespierre  
 Saint-Just  
 Vendée  
 Hébert  
 Jourdan  
 Pichegru  
 Moreau  
 Barras  
 Directory  
 Sieyès  
 Talleyrand  
 Josephine  
 Napoleon I; III  
 Masséna  
 Ney  
 Murat  
 Davout  
 Junot  
 Marmont  
 Lannes  
 Soult  
 Suchet  
 Victor  
 Beauharnais  
 Continental System  
 Code Napoléon  
 Separation of Church and State  
 Louis XVIII  
 Charles X  
 Louis Philippe  
 Guizot  
 Thiers  
 Ledru-Rollin  
 Blanc, Louis  
 Eugénie-Marie de Montijo  
 Crimean War

Franco-German War  
 Bazaine  
 Favre, Jules  
 Gambetta  
 MacMahon  
 Ferry  
 Boulanger  
 Casimir-Périer  
 Faure  
 Loubet  
 Dreyfus, Alfred  
 Waldeck-Rousseau  
 Delcassé  
 Triple Entente  
 Freycinet  
 Ribot  
 Fallières  
 Jaurès  
 Poincaré  
 Viviani  
 Briand  
 Gallieni  
 Joffre  
 War in Europe

#### For the Historians:

Chéruel, P. A.  
 Duruy, V.  
 Froissart, J.  
 Guizot, F. P. G.  
 Hanotaux, G.  
 Houssaye, H.  
 Joinville, Jean  
 Lanfrey, P.  
 Lavissee, E.  
 Luchaire, A.  
 Martin, H.  
 Michaud, J.  
 Michelet, J.  
 Mignet, F. A. M.  
 Montalembert, C. F.  
 Rambaud, A. N.  
 Seignobos, C.

Sorel, A.  
 Stephens, H. M.  
 Sybel, H.  
 Thierry, Amédée  
 Thierry, Augustin  
 Thou, J. A. de  
 Villehardouin, Geoffroy de

### 3. GERMANY.

German history, like the history of France, may be dated from the dissolution of the Frankish Empire. Unlike France, Germany knew no unity until the very latest times. The establishment of the Holy Roman Empire in the tenth century connected the political fortunes of Germany with those of Italy and the Papacy, and the history of the empire is but the history of the separate states within the empire. After 1273, the imperial dignity is held, as a rule, by members of the house of Hapsburg, and the imperial interests become more and more Austrian. Disunion is fostered by the Reformation and perpetuated by the Thirty Years' War. In the eighteenth century, Prussia enters into competition with Austria for leadership in the empire, which, after existing for more than eight hundred years, is dissolved by Napoleon in 1805. The quarrel between Prussia and Austria is fought out in the nineteenth century, and the former triumphs. A new German Empire is formed, differing from the Holy Roman Empire in its national character, and, as the strongest military power on the Continent, occupies a leading place in the European system. See:

Germany  
 Prussia  
 Bavaria

Saxony  
 Württemberg  
 Hanover  
 Baden  
 Verdun, Treaty of  
 Franconia  
 Swabia  
 Lorraine  
 Otho I  
 Holy Roman Empire  
 Henry II, IV, VI  
 Conrad II  
 Investiture  
 Gregory VII  
 Hohenstaufen  
 Guelphs and Ghibellines  
 Frederick I, Barbarossa  
 Frederick II  
 Hapsburg  
 Rudolph I  
 Austria-Hungary  
 Charles IV, V, VI  
 Golden Bull  
 Electors  
 Sigismund  
 Maximilian I  
 Aulic Council  
 Reformation  
 Passau, Treaty of  
 Bohemia  
 Thirty Years' War  
 Leopold I  
 Pragmatic Sanction  
 Frederick William I, III, IV  
 Frederick II  
 Maria Theresa  
 Succession Wars (*Austrian*)  
 Seven Years' War  
 Francis II of Austria  
 Stein  
 Scharnhorst  
 Blücher  
 Gneisenau  
 Leipzig, Battles of

Waterloo  
 Vienna, Congress of  
 Metternich  
 Burschenschaft  
 Zollverein  
 Frankfort, Council of  
 Seven Weeks' War  
 Bismarck-Schönhausen  
 Moltke  
 William I  
 Kulturkampf  
 Triple Alliance  
 William II  
 Caprivi  
 Hohenlohe  
 Bülow  
 Bethmann-Hollweg  
 Jagow  
 Hindenburg  
 Tirpitz  
 War in Europe

For the Historians:

Bulle, K.  
 Dahlmann, F. C.  
 Dahn, F.  
 Droysen, J. G.  
 Dümmler, E.  
 Erdmannsdörffer, B.  
 Gfrörer, A. F.  
 Giesebrecht, F. W. B.  
 Häusser, L.  
 Janssen, J.  
 Lamprecht, K.  
 Marcks, E.  
 Maurenbrecher, W.  
 Müller, Johannes  
 Oncken, W.  
 Ranke, L.  
 Raumer, F. L.  
 Sybel, H.  
 Treitschke, H.  
 Waitz, G.

4. AUSTRIA-HUNGARY.

Austria-Hungary is a political unit merely and in no sense a national State, and its history is largely that of the several states that compose it. The relationship to European affairs resulting from the close connection between the house of Austria and the Holy Roman Empire, for five centuries, is best traced under GERMANY, which see. Here, the internal affairs alone will be touched upon, and the history may be summed up in the history of a family, the Hapsburgs, that, starting with small territorial possessions in the Swabian mountains, brought under its sway by conquest or marriage the heart of Central Europe, from the Carpathians to the Alps and from the Vistula to the Danube and the Adriatic Sea. See:

(a) For Austria:

Austria-Hungary  
 Bohemia  
 Dalmatia  
 Styria  
 Moravia  
 Galicia  
 Tyrol  
 Carinthia  
 Carniola  
 Babenberg  
 Ottokar II  
 Hapsburg  
 Rudolph I  
 Albert II  
 Maximilian I  
 Charles V  
 Ferdinand I, II  
 Maximilian II  
 Thirty Years' War  
 Succession Wars (*Spanish*)  
 Eugène, Prince  
 Joseph II

Leopold II  
 Campo-Formio  
 Lunéville  
 Pressburg  
 Vienna, Congress of  
 Metternich  
 Francis II  
 Francis Joseph I  
 Windischgrätz  
 Radetzky  
 Lombardy  
 Seven Weeks' War  
 Ausgleich  
 Triple Alliance  
 War in Europe

(b) For Hungary:

Hungary  
 Arpad  
 Báthory  
 Louis I, II  
 Sigismund  
 Hunyady, János  
 Matthias Corvinus  
 Mohács  
 Zápolya  
 Tökölyi  
 John III, Sobieski  
 Rákóczy  
 Deák, Ferencz  
 Batthyányi  
 Kossuth  
 Bem  
 Dembinski  
 Görgey  
 Mészáros  
 Klapka  
 Haynau  
 Tisza

(b) For the Historians:

Arneth, A. R.  
 Fessler, I. A.  
 Gindely, A.  
 Hormayr, J.

Krones, F.  
 Mailáth, J.  
 Zeissberg, H.  
 Wolf, Adam

5. THE IBERIAN PENINSULA.

One of the richest regions of the Roman Empire, Hispania, was wrested from the Romans by successive waves of barbarian invaders in the fifth century of our era. The Christian Gothic kingdom was overthrown by the Arabs, who developed in the peninsula a civilization that was long the highest in Europe. The remnants of the Christian inhabitants rallied in the northern mountains and a slow but steady process of reconquest was begun, hastened by the dissolution of the Arab Caliphate, retarded by strife among the various Christian kingdoms, completed before the end of the fifteenth century, when the greater part of the peninsula had been brought under one crown. Portugal alone preserved its independence of Castile. Enriched by the wealth of a newly discovered world and her Lowland possessions, Spain, in the sixteenth century, plays the leading rôle in European affairs and then enters on a course of political and economic decline which has continued to the present day. Portugal and Great Britain have been friends since the beginning of the eighteenth century. See:

(a) For Spain:

Spain  
 Iberians  
 Phœnicia  
 Carthage  
 Hispania  
 Lusitania

Goths  
 Suevi  
 Roderick  
 Moors  
 Tarik  
 Omniads  
 Cordova  
 Mohammedan Art  
 Navarre  
 Asturias  
 León  
 Castile  
 Aragon  
 Almoravides  
 Almohades  
 Granada  
 Boabdil  
 Ferdinand V of Castile  
 Isabella I, II  
 Ximenes  
 Inquisition  
 Cortes  
 Fuero  
 Padilla, Juan  
 Alcántara  
 Calatrava  
 Gonsalvo de Cordova  
 Philip II, III, IV  
 Armada  
 Charles, II, IV  
 Succession Wars (*Spanish*)  
 Alberoni  
 Farnese  
 Godoy  
 Peninsular War  
 Ferdinand VII  
 Carlos, Don  
 Maria Christina  
 Espartero  
 Narváez  
 Prim  
 O'Donnell  
 Castelar  
 Serrano

Amadeus I  
 Alfonso XII, XIII  
 Cánovas del Castillo  
 Sagasta  
 Silvela  
 Spanish-American War

(b) For Portugal:

Portugal  
 Alfonso I, V  
 Diniz  
 John I, III  
 Henry the Navigator  
 Manuel the Great  
 Gama, Vasco da  
 Almeida  
 Albuquerque  
 Braganza, House of  
 Methuen Treaty  
 Pombal  
 Peninsular War  
 Miguel, Dom  
 Pedro, Dom  
 Saldanha  
 Charles I  
 Brazil  
 Manuel I, II  
 War in Europe

(c) For the Historians, see:

Barros, J. de  
 Coxe, W.  
 Dozy, R.  
 Gayangos  
 Lafuente, M.  
 Lea, H. C.  
 Llorente, J. A.  
 Mariana, J.  
 Prescott, W. H.  
 Robertson, W.  
 Zurita Y. Castro

6. ITALY.

The fall of the Western Empire was followed by a struggle between the

Goths and the Byzantines for the possession of Italy. The latter held the south while the north passed from the Goths to the Lombards and the Franks. Constituted with Germany into a shadowy Holy Roman Empire, Italy enters upon a period of utter disunion with the Papal power established in the centre of the peninsula, the north parceled out into independent principalities and republics, the south ruled by Normans, Saracens, French, and Spaniards. The Italian cities rise to great prosperity after the Crusades and become the cradle of the Renaissance. The state of political disintegration continues till the later part of the nineteenth century and Italy suffers from internal strife and foreign domination, Spain and Austria playing the master in the greater part of the peninsula. Union comes to the country from the house of Savoy, whose power, spreading over Sardinia and Piedmont, after a contest with Austria, the Papacy, and Spain, spreads over the entire peninsula. Early Italian history is best studied in the story of separate states and celebrated families. See:

Rome  
 Venice  
 Florence  
 Milan  
 Genoa  
 Pisa  
 Lucca  
 Verona  
 Bologna  
 Ravenna  
 Ferrara  
 Naples  
 Papal States  
 Two Sicilies, Kingdom of  
 Sicily

Foscari  
 Falieri  
 Malatesta  
 Medici  
 Visconti  
 Colonna  
 Orsini  
 Este  
 Borgia  
 Theodoric the Great  
 Belisarius  
 Narses  
 Lombards  
 Saracens  
 Normans  
 Guiscard  
 Crusade  
 Renaissance  
 Charles VIII of France  
 Sforza  
 Condottieri  
 Louis XII of France  
 Ferdinand V of Spain  
 Julius II (Pope)  
 Savoy  
 Napoleon I  
 Suvaroff  
 Nelson  
 Murat  
 Carbonari  
 Holy Alliance  
 Victor Emmanuel I, II, III  
 Charles Albert  
 Mazzini  
 Young Italy  
 Radetzky  
 Manin  
 Cavour  
 Garibaldi  
 Villafranca  
 Rattazzi  
 Ricasoli  
 Crispi  
 Rudini



Depretis  
Humbert I  
Mafia  
Turco-Italian War  
Salandra  
Sonnino  
War in Europe

For the Historians:

Amari, M.  
Balbo, C.  
Botta, C. G.  
Burckhardt, J.  
Cantù, C.  
Cibrario, G. A.  
Farini, L. C.  
Gallenga, A.  
Gregorovius, F.  
Hodgkin, T.  
Johnston, R. M.  
La Farina, G.  
Liudprand  
Muratori, L. A.  
Paulus Diaconus  
Sismondi, J. C.  
Symonds, J. A.  
Villari, P.

7. THE SLAV EMPIRE.

The Slav inhabitants of the plains south of the Finnish lakes received in the ninth century a ruler of Scandinavian stock, whose successors extended their sway to the southern rivers. The Byzantine civilization and religion are introduced. The unity of the country disappears after the tenth century, and its independence is swept away in the thirteenth by Mongol invaders from the east. The power of the Mongols breaks up in the fifteenth century and a new empire is created by the grand princes of Moscow, whose rule is steadily extended to the south and west at the expense of Poland and the Baltic

powers. Peter I brings Russia within the sphere of European politics and gains for his country a predominant place among the northern powers. With the Baltic reached, Russia turns once more to the south and driving the Turks before her, she reaches the Black Sea and seeks to press into the Balkan peninsula. The jealousy of the powers halts her progress and her advance assumes a new direction—eastward and southward in Asia, where the beginnings of her power had been made in the sixteenth century. In her attack on the integrity of the Chinese Empire, she finds a formidable rival in Japan. Internally, after Peter's time, a struggle goes on between the Eastern and Western civilization, which, at the beginning of the twentieth century, finds Russia still a despotism. Poland, at one time the greatest power in central Europe, fell through disunion and its territory was absorbed by Austria, Prussia, and, to the largest extent, by Russia. See:

(a) For Russia:

Russia  
Slavs  
Varangians  
Rurik  
Novgorod  
Kiev  
Vladimir  
Tchernigov  
Batu Khan  
Alexander Nevski  
Moscow  
Kiptchak  
Ivan III, the Great  
Ivan IV, the Terrible  
Godunoff, Boris  
Demetrius

Romanoff, House of  
 Peter I, the Great  
 Streltsi  
 Charles XII of Sweden  
 Anna Ivanovna  
 Dolgoruki  
 Golitzin  
 Biron  
 Anna Karlovna  
 Elizabeth Petrovna  
 Catharine II  
 Poland  
 Armed Neutrality  
 Paul I  
 Alexander I  
 Tilsit  
 Holy Alliance  
 Nicholas I  
 Crimean War  
 Alexander II  
 Serf  
 Nihilism  
 Russo-Turkish War  
 Berlin, Congress of  
 Loris-Melikoff  
 Alexander III  
 Ignatieff  
 Anti-Semitism  
 Nicholas II  
 Finland  
 Siberia  
 Manchuria  
 Russo-Japanese War  
 Goremykin  
 Nicholas (Nikolai Nikolaievitch)  
 War in Europe

(b) For Poland:

Poland  
 Lithuania  
 Teutonic Knights  
 Casimir III, the Great  
 Jagellons  
 Casimir IV

Sigismund the Great  
 Ukraine  
 Cossacks  
 Chmielnicki  
 Thorn  
 John III, Sobieski  
 Succession Wars (*Polish*)  
 Stanislas Leszczyński  
 Augustus II  
 Catharine II  
 Kosciuszko  
 Chlopicki  
 Bem  
 Dembinski  
 Panslavism  
 Aksakoff, I. S.  
 War in Europe

For the Historians:

- (a) Bestuzheff-Ryumin, K. N.  
 Brückner, A.  
 Karamzin, N. M.  
 Kostomaroff, N. I.  
 Pogodin, M. P.  
 Rambaud, A. N.  
 Solovieff
- (b) Chodzko, L. J.  
 Lelewel, J.  
 Niemcewicz, J. U.

8. THE BALKAN PENINSULA.

The Byzantine Empire, successor to the Roman Empire in the eastern Mediterranean, after a thousand years' existence, fell before the Turks, whose power, spreading northward beyond the Danube, extended over Hungary and threatened the Austrian dominions. The rapid decline of the Turks begins with the eighteenth century and has continued to the present day, resulting in the restriction of the Ottoman power to but a fraction of its once vast territories. Russia and Austria have stead-

ily pressed the Turkish power backward, and only the jealousy of the Western powers, England primarily, has preserved the integrity of the Empire. Part of the territory wrested from Turkey has been erected into independent Christian States. In 1908 the Young Turk movement overthrew the old order of things and established a constitutional government. In the Great War Turkey divorced herself from England and cast in her lot with the Teutonic allies. See:

(a) Turkey

Eastern Question

Othman

Amurath I

Janizaries

Bajazet I

Amurath II

Mohammed I

Mohammed II

Mohammed III

Mohammed IV

Mohammed V

Selim I

Solyman

Lepanto

Kiuprili

Kara Mustapha

Eugène, Prince

Mahmud II

Mehemet Ali

Crimean War

Abd ul-Aziz

Abd ul-Hamid

Russo-Turkish War

Berlin, Congress of

Greece

Crete

Armenia

Albania

Ali Pasha

Macedonia

Adrianople

Constantinople

Abd ul-Medjid

Turco-Italian War

Balkan War

War in Europe

(b) Greece

Hetærae

Coray

Ypsilanti

Mavrocordatos

Miaulis

Kanaris

Bozzaris

Kolokotronis

Capo d'Istria

Navarino

Otto I

George I

Trikoupis

Delyannis

Trikoupis, C.

Constantine I

Balkan War

Venizelos

Zaimis

War in Europe

(c) Servia

Czerny George

Obrenovitch

Alexander Karageorgevitch

Milan I

Natalie

Ristic

Alexander I

Peter I, Karageorgevitch

Skupshtina

Bosnia

Herzegovina

Berlin, Congress of

Panslavism

Balkan War

Pashich

War in Europe  
Mijatovich

(d) Bulgaria

Bulgars  
Russo-Turkish War  
Alexander I  
Ferdinand I  
Stambuloff  
Berlin, Congress of  
Balkan War  
Panslavism  
War in Europe

(e) Rumania

Moldavia  
Wallachia  
Kantemir  
Hospodar  
Fanariots  
Ypsilanti  
Ghika  
Russo-Turkish War  
Jews  
Berlin, Congress of  
Bratianu  
Charles I  
Balkan War  
Panslavism  
Ferdinand (Rumania)  
War in Europe

(f) Bosnia

(g) Herzegovina

(h) Montenegro

Berlin, Congress of  
Danilo I  
Panslavism  
Balkan War  
Scutari  
Nicholas I  
War in Europe

(i) Albania

Balkan War  
Essad Toptani

William of Wied  
War in Europe

For the Historians:

Creasy, E. S. (Turkish)  
Hammer-Purgstall (Turkish)  
Lambros (Greek)  
Trikoupis, S. (Greek)  
Ranke, L. von. (Servian)  
Mijatovich, C. (Servian)  
Jirecek, K. (Bulgarian)  
Iorga, N. (Rumanian)

8. THE MINOR NATIONS OF EUROPE.

(a) Denmark

Margaret  
Christian VII  
Christian VIII  
Christian IX  
Christian X  
Schleswig-Holstein  
Frederick III  
Frederick V  
Frederick VI  
Frederick VII  
Frederick VIII  
Norway  
Oscar II  
War in Europe

(b) Sweden

Finland  
Eric  
Kalmar  
Sture  
Gustavus Vasa  
Charles IX  
Gustavus Adolphus  
Oxenstierna  
Christina  
Charles XII  
Gustavus I-V  
Caps and Hats  
Charles XIV, John

Oscar I, II  
 Adolphus Frederick  
 War in Europe

(c) Norway

Normans  
 Harald Haarfagr  
 Iceland  
 Haakon  
 Denmark  
 Christian II, IV, VII  
 Frederick I, II  
 Haakon VII  
 Olaf  
 War in Europe

(d) Netherlands

Burgundy  
 Granvella  
 Margaret of Parma  
 William the Silent  
 Egmont  
 Hoorne  
 Alva  
 Farnese, Alexander  
 Barneveldt  
 Maurice of Nassau  
 Dort, Synod of  
 De Witt  
 Stadtholder  
 William III  
 Louis XIV  
 Wilhelmina  
 War in Europe

(e) Belgium

Flanders  
 Brabant  
 Walloons  
 Netherlands  
 Ostend Company  
 Frère-Orban  
 Rogier  
 Leopold I, II  
 Albert I  
 Vandervelde

Liège  
 Namur  
 Ostend  
 War in Europe

(f) Switzerland

Helvetii  
 Alemannia  
 Burgundy  
 Hapsburg  
 Tell, William  
 Morgarten  
 Sempach  
 Winkelried  
 Morat  
 Zurich  
 Hofer, Andreas  
 Sonderbund  
 War in Europe

For the Historians:

Blok, P. J. (Dutch)  
 Fryxell, A. (Swedish)  
 Geijer, E. (Swedish)  
 Juste, T. (Belgian)  
 Merle D'Aubigné (Swiss)  
 Motley, J. L. (Dutch)  
 Munch, P. A. (Norwegian)  
 Nielson, Y. (Norwegian)  
 Steenstrup, J. C. H. R. (Danish)

10. SOUTH AMERICA AND MEXICO.

Beginning with Mexico in 1519, the great regions of Central and South America were rapidly brought under Spanish rule, Portugal, however, held sway in Brazil, and in Guiana small portions fell to other European nations. The harsh Spanish rule led to bitter but unsuccessful uprisings among the Indian tribes of Peru and Chile. The first quarter of the nineteenth century witnessed the successful revolt of the Spanish dependencies, aided in their struggle by the decidedly

friendly attitude of Great Britain and the United States, of whom the latter now assumes the rôle, largely, of protector over the newly established republics. A decided inaptitude for self-government is evinced by these, and chronic disorder checks national development. Chile, Argentina, and Mexico are, however, prominent exceptions. Brazil, after living tranquilly as an independent empire, enters upon the troubled career of republican politics towards the end of the nineteenth century. The influence of the United States in South America becomes an important factor with the completion of the work of building the Panama Canal. See:

Mexico  
 Mexican Archæology  
 Montezuma  
 Cortés  
 Mendoza, Antonio de  
 Hidalgo, Miguel  
 Morélos  
 Itúrbide  
 Guerrero, Vicente  
 Santa Anna  
 Mexican War  
 Comonfort  
 Juarez  
 Miramon  
 Almonte  
 Maximilian  
 Lerdo de Tejada  
 Diaz, Porfirio  
 Villa  
 Huerta  
 Madero  
 Zapata  
 Central America  
 Guatemala  
 Nicaragua  
 Zelaya

Honduras  
 Salvador  
 Costa Rica  
 Morazán  
 Carrera, Rafael  
 Walker, William  
 Peru  
 Huayna Capac  
 Pizarro, Francisco  
 Pizarro, Gonzalo  
 Almagro  
 San Martin, José de  
 Prado, M. I.  
 Bolivia  
 Chile  
 Araucania  
 Valdivia, Pedro de  
 Carrera, José Miguel de  
 O'Higgins, Bernardo  
 San Martin, José de  
 Balmaceda, José Manuel  
 Argentina  
 Rosas, Juan Manuel  
 Urquiza, Justo José  
 Mitre, Bartolomé  
 Sarmiento, Domingo F.  
 Uruguay  
 Gauchos  
 Artigas, Fernando José  
 Flores, Venancio  
 Paraguay  
 Guaraní  
 Francia, José Gaspar  
 Lopez, Francisco Solano  
 Colombia  
 Ecuador  
 Venezuela  
 Castro, C.  
 Miranda, F.  
 Bolivar, Simon  
 Paez, José Antonio  
 Brazil  
 Pedro I, II  
 Fonseca, Deodoro da

For the Historians and Investigators,  
see:

Ixtlilxochitl

Prescott

Bancroft, H. H.

Bandelier, A. F. A.

Charnay, C. J. D.

Squier, E. G.

Markham, C. R.

Vicuña-Mackenna, Benjamin

## 11. THE FAR EAST.

(1) INDIA. The history of India may be divided into three periods, that of the early Hindu domination, the period of Mohammedan rule, and the period of European supremacy. See:

### (a) For the Peoples:

India

Indian Peoples

Aryan

Dravidians

Tamils

Telugus

Kanarese

Malayalim

### (b) For the History:

India

Bimbisara

Sandrocottus

Ghaznivides

Timur

Baber

Akbar

Shah Jehan

Aurangzebe

Nadir Shah

Ahmed Shah

Gama, Vasco da

Albuquerque

Almeida

Pondicherry

Goa

Dupleix

Clive

East India Company

Hastings, Warren

Cornwallis, Lord

Wellesley, Marquis of

Nana Sahib

For the Religions of India, see Chapter on RELIGION.

(2) CHINA. China presents the spectacle of a nation which, having attained a high degree of civilization at a time when Europe was still barbarian, has been content to remain quiescent while the world has moved forward. In spite of its vast latent strength, it seems destined to become the prey of European ambitions, unless the example of its kindred nation, Japan, should lead it to recognize the civilization of the West, and to observe the preponderant rôle that should be its own in the Orient. See:

China

Fuh-hi

She Hwang-Ti

Han

Genghis Khan

Kublai Khan

Ta Ts'ing

K'ang-hi

Hung-siu-ts'eu

Gordon, Charles George

Li Hung Chang

Kwang-Sü

Far Eastern Question

Tze-hsi

• Yuan Shih-kai

For the Philosophy and Religions of China, see Chapter on RELIGION.

(3) JAPAN. Among the nations of the East, Japan stands forth as an amazing exception to Eastern immobility.

ity. The political balance in the Pacific has been quite upset by the appearance of this new power, which, in less than four decades, has passed from feudalism and Oriental seclusion to a constitutional government and the skilful utilization of the sciences and wisdom of the West. Japan's triumph over China in 1894-95 first marked strength; its magnificent struggle against Russian aggression in China and its participation in the Great War raised the possibility of a quite unexpected development in the relations between Europeans and Mongolians.

See:

Japan  
 Jimmu Tennō  
 Taira  
 Samurai  
 Minamoto  
 Fujiwara  
 Yoritomo  
 Ashikaga  
 Daimio  
 Nobunaga  
 Hideyoshi  
 Iyeyasū  
 Tokugawa  
 Iyemitsu  
 Perry, M. C.  
 Kéiki  
 Mutsuhito  
 Arisugawa  
 II Kamon no Kami  
 Itagaki, Taisūke  
 Ito, Hirobumi  
 Iwákura, Tomomi  
 Okubo, Toshimichi  
 Okuma, Shigenobu  
 Soyeshima Tanéomi  
 Yamagata Aritomo  
 Kato  
 Yoshihito  
 War in Europe

See also:

Nichiren  
 Arai Hakuseki (1657—)  
 Motoori Norinaya (1730—)  
 Hokusai (1760—)  
 Fukuzawa, Yukichi  
 Kido, Takayoshi

For the Authorities, see:

Abeel, D.  
 Beal, S.  
 Biot, E. C.  
 Griffis, W. E.  
 Hirth, F.  
 Julien, S. A.  
 Legge, J.  
 Morrison, R.

## 12. THE UNITED STATES.

Norse explorations in North America, about the year 1000, led to no result, and Europe, before the time of Columbus, had no knowledge of a world beyond the Atlantic. The discovery, in 1492, was followed by a period of exploration, in which Spanish, French, English, and Dutch participated. Settlement follows, and poverty and religious persecution in Great Britain stretches a chain of English speaking colonies along the eastern coast of what is now the United States. Swedes and Dutch give way in time, and with Spain restricted to Florida, England enters into a struggle for possession of the interior with France, whose rule has meanwhile been extended over the basins of the St. Lawrence, the Mississippi, and the Great Lakes. England triumphs, and brings under her authority the disputed territory east of the Mississippi. See:

(a) The Discoverers:

Ericson



Vinland  
 Madog  
 Columbus  
 Vespuccius  
 Cabot  
 Cortereal  
 Verrazano  
 Ponce de Leon  
 Ayllon  
 Narváez, P. de  
 Nuñez Cabeça  
 De Soto  
 Coronado  
 Drake  
 Frobisher  
 Gilbert, Sir Humphrey  
 Gosnold  
 Smith, John  
 Norumbega  
 Cartier  
 Champlain  
 Hudson  
 Nicollet  
 Joliet  
 Marquette  
 La Salle  
 Hennepin  
 Tonty  
 Lewis, Meriwether  
 Clark, William  
 Pike  
 Long, S. H.  
 Bonneville  
 Catlin  
 Whitney, J. D.  
 Hayden  
 Powell, J. W.

(b) The Settlers:

See under the names of the thirteen original colonies; also:

London Company  
 Plymouth Company  
 Jamestown

Yeardley  
 Berkeley  
 Bacon  
 Bradford, William  
 Standish  
 Endecott  
 Winthrop  
 Minuit, Peter  
 Kieft  
 Stuyvesant  
 Hooker, T.  
 Davenport, J.  
 Williams, Roger  
 Hutchinson, Anne  
 Baltimore, Barons of  
 Claiborne  
 Friends  
 Penn  
 Oglethorpe

(c) For the Struggle with the French:

King William's War  
 Queen Anne's War  
 King George's War  
 French and Indian War  
 Pepperrell, Sir William  
 Louisburg  
 Albany Convention  
 Braddock  
 Amherst  
 Abercromby  
 Loudoun  
 Wolfe, James  
 Montcalm  
 Pontiac  
 Paris, Treaties of

England's triumph over France is followed almost immediately by the irreparable loss of the thirteen colonies. The injustice of Parliamentary taxation stirs the colonists to resistance, and the memory of their triumph over the French lends them courage for the struggle. See:

(a) The Pre-revolutionary Period:

Navigation Laws  
 Assistance, Writ of  
 Otis, James  
 Stamp Act  
 Sons of Liberty  
 Boston Massacre  
 Boston Tea Party  
 Boston Port Bill  
 Quebec Act  
 Adams, Samuel  
 Hancock, John

Marion  
 Sumter  
 Pickens  
 Lee, Richard Henry  
 Jones, Paul  
 Wayne, Anthony  
 Clark, George Rogers  
 Lafayette  
 Rochambeau  
 Grasse, Count de  
 Steuben  
 Kalb, Baron de

(b) The Revolution: (1) The Battles:

Lexington  
 Concord  
 Bunker Hill  
 Long Island  
 Trenton  
 Princeton  
 Brandywine  
 Germantown  
 Oriskany  
 Bennington  
 Saratoga  
 Monmouth  
 Camden  
 Cowpens  
 Guilford Court House  
 Eutaw Springs  
 Yorktown

Kosciuszko  
 Pulaski  
 Howe, Lord  
 Clinton  
 Burgoyne  
 Cornwallis  
 Tarleton  
 Jefferson  
 Franklin, B.  
 Livingston, R. R.  
 Deane, Silas  
 Sherman, Roger  
 Morris, Robert  
 Declaration of Independence

(2) The Men:

Warren  
 Putnam  
 Washington  
 Montgomery  
 Arnold  
 Lee, Charles  
 Gates  
 Greene  
 Conway  
 Stark  
 Herkimer  
 Morgan

The thirteen colonies, having vindicated their independence in a protracted war, are impelled for the defence of their now won liberties, and the furtherance of their common welfare, to organize themselves into a federal republic with a written constitution, in nature essentially a compromise between the ideas of local liberty and efficiency of the central authority. The Liberator of the nation is also its first executive. His death is followed by a struggle between the two constitutional principles. The advocates of "strict construction" triumph, and, in the person of Thomas Jefferson, the Republican-Democratic Party assumes power to hold it uninterruptedly for forty years. The

boundaries of the Union are extended by the admission of new States, and the national territory is enormously increased by the acquisition of Louisiana and Florida. Party differences disappear, for a while, after a second war with Great Britain, but a new cause of dissension appears in the form of the slavery question, which replaces constitutional politics by sectional. See:

(a) The Formation of the Union:

Constitution of the United States  
Shays's Rebellion  
Hamilton  
Madison  
Jay  
Pinckney, C. C.  
Wilson, James  
Randolph, Edmund  
Paterson, William  
Henry, Patrick  
Northwest Territory

(b) The Era of Party Strife:

Federalists  
Anti-federalists  
Federalist, The  
Gallatin, A.  
Marshall, John  
Burr  
Genet  
Jay Treaty  
Whisky Rebellion  
X. Y. Z. Correspondence  
Alien and Sedition Laws  
Virginia and Kentucky Resolutions  
Louisiana Purchase  
Lewis and Clark Expedition  
Continental System  
Orders in Council  
Embargo  
Chesapeake, The

Constitution, The  
Erie, Battle of Lake  
Thames, Battle of the  
Chippewa  
Lundy's Lane  
New Orleans, Battle of  
Tippecanoe  
Hull, Isaac  
Hull, William  
Lawrence  
Perry  
Macdonough  
Hartford Convention  
Cushing, Caleb  
Ghent, Treaty of  
Missouri Compromise  
Monroe, James  
Monroe Doctrine

The Democratic Party in the course of time did not fail to adopt many of the principles of the old Federalists, among them notably the national encouragement of internal improvements and the creation of a Government bank. The tendency on the part of a faction to lay stress on these functions of the Government led to the dissolution of the Democratic Party. The Whigs now appear, historically the successors of the Federalists and the predecessors of the Republican Party. The hierarchic succession of presidents ends in 1828, and the Western Democracy triumphs in the person of Andrew Jackson. Sectional feeling, fostered by growing economic differences between North and South, is intensified by the rise in the North of an outspoken spirit of opposition to the institution of slavery. The two political parties for a time eagerly ignore the issue, and Southern statesmen, armed with the threat of a disruption of the Union, succeed in coercing the conservatives in the North.

Territorial expansion, however, forces the slavery question into the foreground; the Whig Party, unwilling directly to challenge the issue, is succeeded by the Republican Party, which will. The Democratic Party is broken in two. With the triumph of the anti-slavery party in 1860, the South secedes from the Union. See:

(a) The Formation of Parties and the

Rise of the Slavery Question:

Democratic Party  
 Adams, John Quincy  
 Crawford, William  
 Jackson, Andrew  
 Caucus  
 Whig Party  
 Clay, Henry  
 Cumberland Road  
 Tariff  
 Nullification  
 McDuffie  
 Calhoun, John C.  
 Hayne, Robert  
 Webster  
 Abolitionists  
 Garrison, William Lloyd  
 Phillips, Wendell  
 Lovejoy, Elijah  
 Lundy, Benjamin  
 Van Buren  
 Marcy, W. L.  
 Harrison, William Henry  
 Tyler  
 Webster-Ashburton Treaty  
 Northeast Boundary Dispute  
 Polk  
 Texas  
 Houston, Samuel  
 Oregon  
 Northwest Boundary Dispute  
 Mexican War  
 Wilmot Proviso  
 Scott, Winfield

Taylor, Zachary

Fillmore

Cass

Clayton-Bulwer Treaty

(b) The Final Struggle over Slavery:

Free Soil Party

Compromise Measures of 1850

Fugitive Slave Law

Seward

Sumner

Davis, Jefferson

Underground Railroad

Pierce, Franklin

Kansas-Nebraska Bill

Popular Sovereignty

Thayer, Eli

Republican Party

Douglas, Stephen A.

Taney, Roger

Dred Scott Case

Buchanan, James

Brown, John

Lincoln, Abraham

Breckinridge, J. C.

Bell, John

Constitutional Union Party

(c) The Civil War:

Civil War in America

Confederate States of America

Stephens, Alexander

Benjamin, Judah P.

Toombs, Robert

1. The Battles:

I. In the East:

Fort Sumter

Big Bethel

Bull Run

Ball's Bluff

Williamsburg

Seven Pines

Mechanicsville

Gaines's Mill  
Savage's Station  
Frazier's Farm  
Malvern Hill  
Bull Run (second)  
Antietam  
Fredericksburg  
Chancellorsville  
Gettysburg

## II. In the West:

Wilson's Creek  
Paducah  
Belmont  
Fort Henry and Fort Donelson  
Pea Ridge  
Shiloh  
Corinth  
Iuka  
Island No. 10  
New Orleans  
Perryville  
Stone River  
Vicksburg  
Chickamauga  
Chattanooga  
Mobile Bay

## III. The Final Campaigns:

Dalton  
Kenesaw Mountain  
Nashville  
Fort McAllister  
Bentonville  
Wilderness  
Spottsylvania Court House  
Cold Harbor  
Monocacy  
Winchester  
Cedar Creek  
Five Forks  
Petersburg  
Appomattox Court House

## 2. The Men:

Grant  
Sherman  
Sheridan  
McClellan  
Meade  
Thomas  
Burnside  
Halleck  
Hooker  
Rosecrans  
Buell  
Hancock  
Pope  
Lyon  
Foote  
Farragut  
Lee  
Jackson  
Johnston  
Johnston  
Longstreet  
Beauregard  
Bragg  
Hood  
Early

## (d) Emancipation Declaration Draft Riots

Four years of civil war established the principle that the United States, once perhaps a federation, is now a nation. Slavery is abolished and a partisan Congress, under the stress of circumstances, gives the ballot to the liberated bondsmen. Reconstructed, the Southern States devote themselves to the task of rebuilding their wasted fortunes on old ruins and new conditions. The South recognizes the lesson of the war in its bearing on the nature of our Government, but refuses to recognize the capacity for political and social equality in the negro, and in the last

years of the nineteenth century enters upon a deliberate policy of negro disfranchisement through State legislation. In the North and West, the era is one of extraordinary material growth, and political questions of the time are largely economic—currency, tariff, labor, and monopoly. With the acquisition of the Spanish possessions in the Pacific, and the assumption of the task of building the interoceanic Panama Canal, the United States begins its career as a world power. See:

(a) The Restored Union:

Johnson, Andrew  
Reconstruction  
Freedman's Bureau  
Carpet Baggers  
Ku-Klux Klan  
Knights of the Golden Circle  
Force Bill  
Tenure of Office Act  
Stanton  
Alaska  
Chase, S. P.  
Stevens, T.

(b) From the Close of the Civil War Period:

Grant, U. S.  
Alabama Claims  
Grange  
Credit Mobilier of America  
Virginian Massacre  
Whisky Ring  
Electoral Commission  
Custer  
Modoc  
Sioux  
Indians  
Centennial Exhibition  
Hayes, R. B.  
Tilden

Strikes and Lockouts

Bland, R. P.

Greenbacks

Greely, H.

Garfield, J. A.

Arthur, C. A.

Harrison, B.

Bering Sea Controversy  
Tariff

Hawaiian Islands

Cleveland, G.

Venezuela

World's Columbian Exposition

McKinley, Wm.

Blaine, J. G.

Reed, T. B.

Spanish-American War

Cuba

Philippines

Porto Rico

Trusts

Pan-American Exhibition.

Roosevelt, T.

Hay-Pauncefote Treaty

Panama Canal

Root, E.

Louisiana Purchase Exposition

Russo-Japanese War

Hughes, C. E.

Trusts

Lodge, H. C.

Poindexter, Miles

Taft, Wm. H.

Pugo

Knox, P. C.

Conservation

Trusts

Tariff

Lorimer, Wm.

Aldrich, N. W.

Mexico, *History*

La Follette, R. M.

Cummins, A. B.

Penrose, B.

Borah, Wm.

Wilson, W.

Bryan, Wm. J.

Parker, A. B.

Underwood, O.

Brandeis, L. D.

McAdoo, Wm. G.

Daniels, J.

Reserve Bank, Federal

Mexico, *History*

Tariff

Mann, J. P.

O'Gorman, J. A.

Newlands, F. G.

Kern, J. W.

Owen, R. L.

Gore, T. P.

Smith, Hoke

Stone, Wm.

War in Europe

Party Names

Money

Coinage

Labor Organizations

Arbitration

Railways (Interstate Commerce  
Act)

Trusts

Tariff

For the Historians:

Adams, C. F.

Adams, H.

Bancroft, G.

Bancroft, H. H.

Beard, C. A.

Brodhead, J. R.

Bryce, James

Burgess, J. W.

Channing, F.

Coffin, C. C.

Curtis, G. T.

Dodge, T.

Doyle, J. A.

Dunning, W. A.

Fiske, J.

Frothingham, R.

Gayarré, C.

Harrisse, H.

Hart, A. B.

Higginson, T. W.

Hildreth, R.

Holst, H. E. von

Johnston, A.

Lodge, H. C.

Lossing, B.

McMaster, J. B.

Palfrey, J. G.

Parkman, F.

Peter Martyr

Rhodes, J. F.

Robinson, J. H.

Ropes, J. C.

Schouler, J.

Shea, J. G.

Sloane, W. M.

Sparks, J.

Thorpe, F. N.

Thwaites, R. G.

Wilson, W.

Winsor, J.

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# Chapter 2. Law and Political Science

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**N**ATIONAL or Municipal law is commonly divided into two general classifications, Substantive Law, and Adjective or Remedial Law. Substantive Law prescribes and defines the normal relations of social and political life, that is, legal rights, obligations, and privileges, as distinguished from violations of the normal, legal order. (See Substantive Law.) Adjective or Remedial Law deals with abnormal conditions, such as crimes, and with the methods of enforcement of legal rights. Both of these classifications are severally divided into Public Law and Private Law. The title, Public Law, is applied to those subjects which have to do with the relations of individuals to the various branches of government. Private Law includes the rules governing the relations of individuals to each other, and their rights in and over property. While, for some purposes, Substantive and Remedial Law are so closely connected that a complete knowledge of one is not possible without an acquaintance with the other, yet, in general, it may be said that, for practical purposes, the average layman is concerned chiefly with the rules of Substantive Law, except, perhaps, Public Remedial Law—the Law of Crimes. For example, it is quite necessary that a person in business be somewhat familiar with the ordinary principles of the Law of Contracts, but it is not necessary that he should know how to proceed in law to obtain redress for the breach of a contract.

International Law is distinguished from Municipal Law, in that the former deals with the relations of nations with each other, and such rules of law as will be recognized by nations in dealing with the citizens of each other, while the latter deals with the relations of one nation to its citizens, and the relations of the citizens with each other. International Law is administered, generally, in the various courts of each nation when applicable, but the refusal of a nation to recognize any of its principles could only be met by a declaration of war on the part of the aggrieved nation or nations, whereas the sovereign power of a nation sanctions and enforces Municipal or National Law. Therefore, to avoid confusion, topics in International Law are placed in a separate classification.

For a General Discussion of the Nature and Purposes of Law, see:

Law	Municipal Law
Jurisprudence	Mercantile Law
Substantive Law	Military Law
International Law	

## A. Substantive Law

### I. PUBLIC SUBSTANTIVE LAW.

This branch of substantive law is commonly divided into two general

classifications, CONSTITUTIONAL and ADMINISTRATIVE LAW. Constitutional law deals with the nature and powers of the Government, and correlatively with



the rights and privileges of citizens with reference to the Government. The name, ADMINISTRATIVE LAW, is applied to that portion which controls and regulates the enforcement of the will of the Government, as expressed by constitutions, statutes, etc.

### 1. CONSTITUTIONAL LAW:

Constitution  
Constitutional Law  
Constitution of the United States  
Magna Charta  
Amendment  
Federal Government  
Police Power  
Veto  
Eminent Domain  
Bill of Rights  
Civil Rights Bill  
Bill of Attainder  
Sovereignty  
State  
Ex post facto  
Retroactive  
Due Process of Law  
Congress  
Legislature  
Legislation  
Conflict of Laws  
Act  
Act of Parliament  
Repeal  
Citizen  
Alien  
Naturalization  
Allegiance  
Domicile  
Alien and Sedition Acts  
Expatriation  
Expulsion  
Liberty of Individual  
Liberty, Religious  
Emancipation

Reprieve  
Territories  
Consolidation Acts  
Restraint of Trade  
Interstate Commerce Act  
Granger Cases  
Concurrent Jurisdiction  
Original Package  
Income Tax  
Inheritance Tax  
Dartmouth College Case  
Slaughter-House Cases  
Dred Scott Case  
Fugitive Slave Law  
Homestead Laws  
Poor Laws  
Tenure of Office Act  
Legal Tender Cases  
Debt, Public  
Convention  
Election  
Vote  
Fishing Laws  
Franchise

### 2. ADMINISTRATIVE LAW:

Administrative Law  
Executive Department  
State, Department of  
Diplomacy  
High Commission  
Commission  
Commissioner  
Municipality  
Municipal Government  
Municipal Law  
Municipal Ownership  
Municipal Reform Acts  
Civil Administration  
Court  
Supreme Court of U. S.  
Courts, Military  
Court Baron  
Court of Session

County Court  
 Common Bench  
 Probate Court  
 Petty Sessions  
 District Court  
 Sheriff's Court  
 Ecclesiastical Court  
 King's Bench  
 Cassation, Court of  
 Claims, Court of  
 Instance, Court of  
 Inns of Chancery  
 Inns of Court  
 Ordinance  
 By-law  
 Charter  
 Building Acts  
 Cemetery Laws  
 Factor's Acts  
 Intoxicating Liquors  
 Grand Jury  
 Justice, Lord  
 Sheriff  
 Justice of the Peace  
 Marshal  
 Coroner  
 Assessors  
 Auditor  
 Alderman  
 Attorney-General  
 Surrogate  
 Judge-Advocate  
 Judge  
 Referee  
 Justice  
 Justice, Department of  
 Justice of the Peace  
 Appointment

## II. PRIVATE SUBSTANTIVE LAW

For convenience this portion of the substantive law is divided into two classifications, the Law of Persons and the Law of Property.

### 1. LAW OF PERSONS:

In law, both natural persons and those creations of the law, such as corporations, known as legal entities, or juristic persons, are classed together in the Law of Persons, as the same general principles apply to them. Under the title NATURAL PERSONS, are grouped titles dealing with the peculiar privileges and disabilities of married women, infants, and persons of unsound mind. Topics dealing with the family relation are for convenience grouped together.

#### (a) *Natural Persons:*

#### I. Persons Exercising Incomplete or Special Rights:

Infant  
 Minor  
 Legitimacy  
 Apprentice  
 Disability  
 Married Women  
 Feme Covert  
 Coverture  
 Insanity  
 Lucid Interval  
 Capacity

#### (b) *Family Relations:*

Husband and Wife  
 Settlement  
 Marriage  
 Divorce  
 Alimony  
 Adultery  
 Separation  
 Abandonment  
 Paraphernalia  
 Community of Property  
 Emancipation  
 Separate Estate

Parent and Child

Adoption

Bastard

Ancestor

Affinity

Consanguinity

Domicile

Guardian

(c) Juristic Persons:

Company

Corporation

Ultra Vires

De Facto

Charitable Trusts

Ecclesiastical Corporation

Joint Stock Company

Limited Companies

Limited Liability

Regulated Companies

Stock Company

Dividend

Director

Trust

Trust Fund Doctrine

2. LAW OF PROPERTY:

The term property includes everything that is the subject of possession and ownership, whether tangible or intangible. The various kinds of property are naturally divided into two classifications, REAL and PERSONAL. Real Property includes lands, tenements, and hereditaments, and interests therein. Subjects dealing with the disposition and incumbrance of real property *inter vivos* are also placed under this title. Personal Property includes all movable objects of property, commonly known as chattels, and such claims, obligations, and rights of action as are the subject of transfer. Topics treating of the transfer of property, both real and personal, by will or descent, are classed un-

der the title, SUCCESSION AND INHERITANCE.

(a) *Real Property*:

i. Nature of Real Property:

Real Property

Real Estate

Hereditament

Tenement

Mines and Mining

Feudalism

Fee

Fief

Feud

Feu

Accession

ii. Systems of Tenure:

Tenure

Seisin

Manor

Socage

Frankalmoigne

Gavelkind

Ground-Annual

Demesne

Ancient Demesne

Borough English

Burgage Tenure

Tenant Right

Community of Property

Mortmain

Subinfeudation

Sergeanty

Landlord and Tenant

Attornment

Lease

Leasehold

Common, Tenancy in

Tenancy at Sufferance

Tenancy at Will

Rent

Occupancy

Mining Claim

Life Estate  
 Conditional Fee  
 Remainder  
 Reversion  
 Freehold  
 Dower  
 Curtesy  
 Entry, Right of  
 Entirety  
 Equity of Redemption  
 Equitable Estate  
 Riparian Rights  
 Rivers, Navigable and Non-navigable  
 Inclosures of Commons  
 Use and Occupation  
 License  
 Pew Rights

iii. Transfer and Incumbrance of Real Property:

Alienation  
 Incumbrance  
 Bargain and Sale  
 Conveyance  
 Conveyancing  
 Land Transfer, Reform in  
 Abstract of Title  
 Search of Title  
 Deed  
 Habendum  
 Restrictive Covenants  
 Conditional Limitation  
 Quit Claim  
 Lease and Release  
 Demise  
 Executory Devise  
 Shifting Use  
 Entail  
 Shelley's Case, Rule in  
 Enrollment  
 Power of Appointment  
 Power  
 Ejectment

Eviction  
 Adverse Possession  
 Common Assurance  
 Elegit, Estate by  
 Jointure  
 Escrow  
 Settled Estate  
 Tax Sale  
 Tax Title  
 Cloud on Title  
 Perpetuity  
 Prescription  
 Quit Rent  
 Office Found  
 Partition  
 Mortgage  
 Merger  
 Tacking of Mortgages  
 Mechanic's Lien  
 Servitude  
 Easement  
 Equitable Easement  
 Incorporeal  
 Equitable Mortgage  
 Building Loans  
 Donis Conditionalibus  
 Domesday Book  
 Recording Acts  
 Recording of Deeds  
 Torrens System  
 Title, Registration of  
 Title Insurance

(b) *Personal Property:*

i. Possession:

Chattel  
 Movables  
 Confusion  
 Treasure-Trove  
 Chose in Action  
 Fixtures  
 Emblements  
 Estray  
 Good-Will

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>Finding</li> <li>Oysters, Law as to</li> <li>Wreck</li> <li>ii. Patents, Patent Law :             <ul style="list-style-type: none"> <li>Letters Patent</li> <li>Trademark</li> <li>Trade-name</li> <li>Copyright</li> <li>Literary Property</li> <li>Invention</li> <li>Caveat</li> </ul> </li> <li>iii. Contracts, Obligations, and Intangible Property Rights :             <ul style="list-style-type: none"> <li>Contract</li> <li>Obligation</li> <li>Covenant</li> <li>Consideration</li> <li>Rescission</li> <li>Discharge</li> <li>Breach</li> <li>Subrogation</li> <li>Abrogation</li> <li>Suretyship</li> <li>Pledge</li> <li>Reward</li> <li>Guaranty</li> <li>Gift</li> <li>Claim</li> <li>Debt</li> <li>Creditor</li> <li>Commercial Law</li> <li>Debtor</li> <li>Payment</li> <li>Chose in Action</li> <li>Accord and Satisfaction</li> <li>Assignment</li> <li>Donation</li> <li>Joint Ownership</li> <li>Sale</li> <li>Bill of Sale</li> <li>Auction</li> <li>Market Overt</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>Caveat Emptor</li> <li>Delivery</li> <li>Condition and Conditional</li> <li>Vendor's Lien</li> <li>Lien</li> <li>Bailment</li> <li>Carrier, Common</li> <li>Baggage</li> <li>Bill of Lading</li> <li>Forwarding</li> <li>Consignment</li> <li>Stoppage in Transitu</li> <li>Joint Adventure</li> <li>Freight</li> <li>Negotiable Instruments</li> <li>Negotiable Paper</li> <li>Promissory Note</li> <li>Check</li> <li>Bill of Exchange</li> <li>Bank-Bills</li> <li>Exchequer Bills</li> <li>Bought and Sold Notes</li> <li>Specialty</li> <li>Bond</li> <li>Stock</li> <li>Coupon</li> <li>Credit, Letter of</li> <li>Warehouse Receipt</li> <li>Bottomry Bond</li> <li>Indorsement</li> <li>Dishonor</li> <li>Exchange</li> <li>Interest</li> <li>Agent</li> <li>Factor</li> <li>Partnership</li> <li>Mercantile Agent</li> <li>Mercantile Agency</li> <li>Master and Servant</li> <li>Joint Liability</li> <li>Insurance</li> <li>Life Insurance</li> <li>Accident Insurance</li> <li>Wager Policy</li> </ul> |
|---|---|

Account  
Deposit  
Voucher  
Receipt  
Seal  
Notary Public  
Acknowledgment  
Debenture

(c) *Succession and Inheritance:*

Decedent  
Estate  
Inheritance  
Intestacy  
Distribution  
Succession ab Intestato  
Surveyorship  
Primogeniture  
Inventory  
Administration  
Will

Testament  
Appraisement  
Legacy  
Residuary Legacy  
Ademption  
Advancement  
Codicil  
Share  
Beneficiary  
Per Stirpes  
Devise  
Personal Representative  
Executor  
Undue Influence  
Deathbed, Law of  
Heir  
Heirloom  
Accumulations  
Lapse  
Posthumous Child

## B. Remedial Law

### I. PUBLIC REMEDIAL LAW.

This portion of the Adjective, or Remedial, Law deals with crimes, the penalties therefor, and the method of prosecution of accused persons by the State. We shall first take up those topics which define particular crimes, under both statutes and the common law, and then those which deal with the prosecution and punishment of crimes. See:

Adjective Law

#### 1. *Crimes, Misdemeanors, etc.:*

Crime  
Criminology  
Criminal Law  
Misdemeanor  
Accessory  
Accomplice  
Infamy

Felony  
Barratry  
Blackmail  
Blasphemy  
Body-Snatching  
Bribery  
By-Bidding  
Burglary  
Embezzlement  
Robbery  
Stolen Goods  
Receiving Stolen Goods  
Assault and Battery  
Security  
Security of Person  
Manslaughter  
Homicide  
Murder  
Malpractice  
Consent

Infanticide	Arraignment
Arson	Search
Smuggling	Bench Warrant
Counterfeiting	Search Warrant
Subornation of Perjury	Writ
Compounding of Felony	Attainder
Suicide	Autrefois Acquit
Misprision	Benefit of Clergy
Treason	Capital Punishment
Overt Act	Charge and Specification
Malicious Mischief	Commitment
Extortion	Corporal Punishment
Forgery	Corruption of Blood
Sunday	Fine
Gambling	Forfeiture
Disturbance	Hard Labor
Eavesdropping	Information
Embracery	Indictment
Engrossing	Justification
Forestalling	Ordeal
Monopoly	Outlawry
Harboring	Civil Death
Champerty	Peine Forte et Dure
Concealment	Penalty
Corrupt Practices	Posse Comitatus
Simony	Nolle Prosequi
Piracy	Prisoner
Policy	Prosecution
Fornication	Prosecutor
Rape	Voir Dire
Incest	Punishment
Rescue	Self Defense
Riot	Sentence
Abortion	State's Evidence
False Pretenses	Corpus Delicti
Common Scold	Ne Exeat
Sumptuary Laws	Torture
Trading Stamps	Extradition
Habitual Drunkard	Locus Delicti

*2. Criminal Procedure and Punishment of Crimes:*

Criminal Procedure  
Arrest

II. PRIVATE REMEDIAL LAW.

This division of Remedial Law includes the law of Torts and Civil Practice and Procedure. Torts are

wrongs other than those arising out of contract, for which the injured party has a right of action. A tort action is not assignable and is not strictly a property right, and, therefore, the law of torts is properly considered remedial law. Under the title, Civil Practice and Procedure, are grouped all topics dealing with the enforcement of civil rights of action of a private nature.

### 1. TORTS, OR CIVIL WRONGS.

- Conversion
- Trespass
- Assault
- Trover
- Fraud
- Fraudulent Conveyance
- Infringement
- Slander of Title
- Defamation
- Slander
- Libel
- Contribution
- Intimidation
- Accident
- Injury
- Misrepresentation
- Nonfeasance
- Nuisance
- Negligence
- Malfeasance
- False Imprisonment
- Malicious Prosecution
- Mayhem
- Pollution of Watercourses
- Criminal Conversation
- Employer's Liability
- Fellow-Servants

### 2. CIVIL PRACTICE AND PROCEDURE.

In English jurisprudence, three distinct systems of procedure, corresponding and adapted to distinct systems of jurisprudence, were developed respect-

ively by the courts of common law, the courts of chancery, and the courts of admiralty. The common law procedure is much older than the procedure in either equity or admiralty, as practiced by the English courts, the *curia regis*,—which was the forerunner of the English Courts of Exchequer, Common Pleas, and King's Bench, in which the common law procedure was developed,—having been established in the early part of the twelfth century. Procedure in equity is much simpler than procedure at common law. Its essential characteristics are based on the fact that the sole power of that court is to command things to be done, and not directly to transfer or otherwise affect the rights of litigants. Procedure in admiralty was founded upon the Roman law and corresponds in many particulars to the equity system. The embarrassment experienced as a consequence of the technical character of the common law procedure has led to many reforms by legislation.

- Action
- Limitation of Actions
- Civil Action
- Civil Procedure
- Forms of Action
- Admiralty Law
- Equity
- Procedure
- Practice
- Pleading
- Process
- Code
- Code Napoléon
- Service of Papers and Process
- Next Friend
- Parties
- Name
- Plea



Common Counts	Month
Common Forms	Attachment
Common Plea	Foreign Attachment
Common Recovery	Letters Rogatory
Debt, Action of	Lis Pendens
Detinue	Oath
Assumpsit	Notary Public
Foreclosure	Precept
Replevin	Discovery, Bill of
Bill in Equity	Cognovit
Real Action	Cognizance
Civil Death	Color
Claim	Subpœna
Lawyer	Recoupment
Attorney	Ex Parte
Advocate	Distringas
Barrister	Garnishment
Counselor	Entry, Writ of
Solicitor	Quia Timet
Disbarment	Qui Tam Action
Client	Interrogatories
Plaintiff	Affidavit
Defendant	Bill of Particulars
Respondent	Certiorari
Joinder	Habeas Corpus
Writ	Motion
Declaration	Inquiry, Writ of
Confession and Avoidance	Inquisition
Answer	In Personam
General Issue	In Rem
Verification	Interpretation
Demurrer	Interpleader
Disclaimer	Injunction
Defense	Prohibition
Forma Pauperis, In	Special Proceeding
Cross-Bill	Specific Performance
Confession of Judgment	Trustee Process
Case	Warrant
Chambers	Quo Warranto
Chancery	Intervention
Cestui que Trust	Invoice
Cestui que Use	Bill of Peace
Master in Chancery	Acknowledgment
Citation	Civil Damage Acts

Forcible Entry and Detainer	Proof
District Attorney	Handwriting
Hilary Term	Testimony
Oyer and Terminer	Privilege
Venue	Privileged Communication
Judicature Acts	Laches
Jurisdiction	Dictum
Judge	Precedent
Jury	Res Adjudicata
Challenge	Presumption
Judge Advocate	Declaration or Affirmation
Oyer	Alteration
Stay	Access
Stare Decisis	Ambiguity
Damages	Argument
Day	Verdict
Marshalling	Special Verdict
Trial	Scotch Verdict
Mistrial	Judgment
Nonsuit	Award
Incident	Appeal
Judicial Notice	Bill of Costs
Evidence	Taxation of Costs
Exception	Bill of Exceptions
Circumstantial Evidence	Execution
Burden of Proof	Supersedeas
Condonation	Exemption
Admission	Sequestration
Examination	Distress
Cross Examination	Equitable Assets
Witness	Receiver
Expert	Winding Up of Company

### C. International Law

The subjects or persons of International Law are independent sovereign States or nations. The community constituting such State is permanently established for a political end, is possessed of a defined territory, and is independent of external control. If one or more of these elements be lack-

ing, the community is not a State in the sense of International Law. Individuals choose their associates, and States likewise determine whether and when they wish to maintain relations with a newcomer. A fundamental proposition of International Law is the equality of States, of which Chief Justice Mar-

shall said: "No principle of general law is more universally acknowledged than the perfect equality of nations. Russia and Geneva have equal rights. It results from this equality that no one can rightfully impose a rule on another." See:

International Law  
Treaty  
Diplomacy  
Diplomatic Agents  
Envoy  
Embassy  
Ambassador  
Neutrality  
Enemy  
Embargo  
Blockade  
Contraband  
Mare Clausum  
High Seas  
Territorial Waters  
Seashore

Tide Waters  
Bering Sea Controversy  
Extraterritoriality  
Prescription  
Privateering  
Piracy  
Award  
Convoy  
Extradition  
Foreign Judgment  
Foreign Law  
War; War in Europe; War Zone  
Truce  
Acts of Hostility  
Comity of Nations  
Mainprize  
Navigation, Freedom of  
Navigation Laws  
Recapture  
Retaliation  
Rules of the Road  
Salvage  
Seamen, Laws Relating to

## D. History and Miscellany

### 1. AGRARIAN LAW:

Anglo-Saxon Law  
Customary Law  
Common Law  
Civil Law  
Civil Church Law  
Twelve Tables  
Salic Law  
Scotch Law  
Spanish Law  
Oléron, Laws of  
Law Merchant

### 2. PARLIAMENTARY LAW:

Revised Statutes  
Medical Jurisprudence  
Maxims

### Legal Education

3. The following are a few of the names in the ranks of jurists, lawyers, and publicists of all time:

Austin, John  
Betts, S. R.  
Binney, Horace  
Black, J. S.  
Blackstone, William  
Bluntschli, J. K.  
Bodin, J.  
Bracton, Henry de  
Brougham, Lord  
Campbell, John  
Choate, Rufus  
Coke, Edward

Cooley, T. M.  
Curtis, G. T.  
Ellsworth, Oliver  
Erskine, Lord  
Fearne, Chas.  
Feuerbach, P. J. A.  
Field, D. D.  
Field, S. J.  
Filangieri, G.  
Fortescue, John  
Gans, E.  
Glanvill  
Grotius, Hugo  
Hale, Matthew  
Holt, John  
Janet, Paul  
Jeffreys, Lord  
Johnson, Reverdy  
Kent, James  
Laboulaye, E. L.  
Lamar, L. Q. C.  
Langdell, C. C.

Lieber, Francis  
Livingston, Edward  
Lowell, A. L.  
Maine, Henry  
Mansfield, Earl  
Marshall, John  
Montesquieu, C.  
Moore, J. B.  
Pardessus, J. M.  
Parsons, Theophilus  
Plowden, E.  
Pollock, F.  
Portalis, J. E. M.  
Pufendorf, S.  
Savigny, F. K.  
Smith, Goldwin  
Stephen, J. F.  
Story, J.  
Taney, R. B.  
Tocqueville, A. C.  
Wharton, F.  
Woolsey, T. D.

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# Chapter 3. Sociology

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## Sociology

**S**OCIAL science presents a theoretical and a practical aspect, of which the latter, at the present time, is the more important. Speculation on the origins of social life, the evolution of social institutions, and the nature of existing social bonds has been rich in theories, diverse in view, but casting light on all the course of human development. Society has been variously regarded as an aggregate, an organization, or an organism, and accordingly as it has been regarded its rights and duties as against the individual have been outlined. The influence of the collective body and the collective mind on the body and mind of the individual forms one of the most fascinating topics of sociology, fascinating because of the close connection that may be established between individual and social progress. But as yet scarcely sufficient material has been collected to make social theory strictly scientific, and the greater interest, probably, attaches to what has been called the practical aspect of social science, the study, namely, of contemporary social conditions and the problems which they create. Thus it would not be far from the truth to call practical sociology, social pathology, for as a matter of fact the attention of the working sociologist is directed, in greater part, to the study of the ills of the social body, a study of those individuals and classes of individuals whose presence in the midst of society is a burden or a source of danger to society or the cause of misery to themselves. In this respect social science deals with the helpless and the vicious and is largely coincident with humanitarianism. Theoretical sociology is most closely allied to Anthropology and History, going to the latter for its evolutionary data and to the former for origins. Practical sociology depends very largely on statistics.

I. The methods and theories of sociology are treated at length under that heading, supplemented by minor articles on subsidiary topics. This article, therefore, should be made the starting point on reading. See:

Sociology  
Man, Science of  
Anthropo-geography  
Acclimatization  
Environment  
Standard of Living  
Crowd

A discussion of various social institutions which form part of the data

of the sociologist, such as the Family, Marriage, the Tribe, etc., will be found in the chapter on Anthropology and Ethnology.

II. 1. Taking human aggregates as its subject matter, practical sociology draws the greatest uses from statistics. The gathering of statistical data is being initiated wherever governments have as yet failed to assume the office, and where official enumerations prevail their scope is constantly being widened. The study of population is now well advanced. See:

Demography  
 Census  
 Population  
 Vital Statistics  
 Births, Registration of  
 Illiteracy  
 Transportation, Penal  
 Immigration  
 Emigration  
 Migration  
 Colony  
 Oriental Migration  
 Naturalization  
 Suicide  
 Infanticide  
 Divorce  
 Marriage  
 Statistics

2. "Dependents, Defectives, Delinquents," adequately describes the subjects dealt with by the social pathologists. In this immensely broad field, private efforts coöperate with State activity, the former through investigations and advocacy largely, the latter through remedial legislation and the use of State resources. For a study of the dependent and defective classes, see:

Dependents, Defectives, Delinquents  
 Social Debtor Classes  
 Debt  
 Pauperism  
 Poor Laws  
 Poor Rate  
 Casual Poor  
 Mendicancy  
 Eugenics  
 Tramp  
 Vagrant  
 Unemployment  
 Workhouse  
 Almshouse

Charitable Trusts  
 Rockefeller Foundation  
 Rockefeller, J. D.  
 Rockefeller, J. D., Jr.  
 Carnegie, A.  
 Charities  
 Charities and Correction, National  
     Conference of  
 Charity Organization Society  
 Brinkerhoff, Roeliff  
 Elberfeld System  
 Blind, Education of the  
 Keller, H. A.  
 Perkins, T. H.  
 Bridgman, L.  
 Howe, S. G.  
 Deaf Mute (*Institutions*)  
 Gallaudet, E. M.  
 Insane Asylum  
 Insanity  
 Idiocy  
 Mental Defectives  
 Mental Pathology  
 Medical Jurisprudence  
 Bedlam  
 Degeneracy  
 Jukes, The

3. Of dependent classes, children, naturally, absorb a large share of the attention of the sociologist and the charity worker. The mission here is not one of relief only, but of redemption, and successful effort in this field discounts future dangers to society. See:

Dependent Children  
 Foundling Hospital  
 Penology  
 Crèche  
 Marbeau, J. B.  
 Infant School  
 Ragged Schools  
 Rauhes Haus

George Junior Republic  
 Parks and Playgrounds  
 Juvenile Court  
 Juvenile Offenders  
 Lindsey, B. B.  
 Children, Societies for  
 Cruelty to Children, Prevention of  
 Children's Aid Society  
 Schools  
 Wirt, Wm. A.

4. Sufficient reason exists for speaking of a criminal class to make Criminology an independent branch of investigation with something of the methodology of a science. The delinquent, the criminal, is regarded as at war with society. The causes that have changed the course of nature in him and made him anti-social may be heredity or environment or both. The prevention and punishment of crime and the possible reformation of the criminal form the subject matter of the "science." See:

Criminology  
 Lombroso, Cesare  
 Bertillon System  
 Finger Prints  
 Punishment  
 Corporal Punishment  
 Flogging  
 Penology  
 Capital Punishment  
 Prisons  
 Osborne, T. M.  
 Convict  
 Convict Labor  
 Clinton State Prison  
 Newgate  
 Fleet Prison  
 Millbank Prison  
 Bicêtre  
 Conciergerie

Transportation, Penal  
 Botany Bay  
 Bagnes  
 Recidivists  
 Reformatories  
 Elmira Reformatory  
 Juvenile Offenders  
 Brockway, Z. R.  
 Ticket of Leave  
 Mettray  
 Beccaria, C. B.  
 Howard, John  
 Round, W. M.  
 Fliedner, T.  
 Fry, Elizabeth  
 Prison Association, American  
 Prison Buildings  
 International Prison Congress

5. The vices of individuals, as well as of classes, affect the welfare of the body politic. (a) The standard of personal purity is rising with the general heightening in moral tone. (b) The evils resulting from the abuse of liquor have led to one of the most notable movements of the nineteenth century. See:

(a) Family  
 Marriage  
 Divorce  
 Infanticide  
 Syphilis  
 Concubinage  
 Eugenics  
 Celibacy  
 Illegitimacy  
 Bastard  
 Prostitution  
 White Slavery  
 (b) Intoxicating Liquors  
 Intoxication  
 Temperance  
 Prohibition

Prohibition Party (Under Tem-  
perance)

License

Liquor Traffic

Excise

Local Option

Gothenburg System

Abstinence Societies

Mathew, T.

Dow, N.

Gough, J. B.

Keeley, L.

Chafin, E. W.

Lend-a-Hand Clubs

Loyal Temperance League

Woman's Christian Temperance  
Union

World's Woman's Christian Tem-  
perance Union

Temperance, Sons of

Good Templars, Independent Or-  
der of

6. The problem of remedying so-  
cial evil has drawn the attention of  
men in all ages, and thinkers have been  
fond of busying themselves with the  
construction of ideal forms of society  
since the days of Plato. More than  
philosophers' dreams, however, are the  
great social movements of modern  
times, whose aim is the reorganization  
of society on a different basis than that  
of the present—private property.

(a) For the literary utopias, see:

Plato (The Republic)

Campanella (The City of the  
Sun)

Defoe, Daniel (An Essay on  
Projects)

More, Thomas (Utopia)

Harrington, James (Oceana)

Bellamy, Edward (Looking  
Backward)

Bacon, Francis (New Atlantis)  
Fénelon, François (Voyage dans  
l'Île des Plaisirs)

(b) For Communism, see:

Communism

Communitic Societies

Socialism

Shakers

Owen, Robert

Blanc, J. J. L.

Harmonists

New Harmony

Cabet, Etienne

Icarians

Saint-Simon, C. N.

Fourier, F. M. C.

Anarchism

Wells, H. G.

Brook Farm

Hopedale

Oncida Community

Zoar Community

Koreshan Ecclesia

Amana

Noyes, J. H.

Perfectionists

Taborites

Moravians

Anabaptists

Separatists

Ephrata

(c) For Socialism, see:

Socialism

Collectivism

Fourierism

Nationalism

Communism

Value

Capital

Industrial Revolution

Debs, E. V.

Berger, V. L.

National Workshops



Saint-Simon, C. H.  
 Fourier, F. M. C.  
 Rodbertus, J.  
 Enfantin, B. P.  
 Bazard, A.  
 Considérant, V. P.  
 Babeuf, F. N.  
 Proudhon, P. J.  
 Blanc, J. J. L.  
 Marx, Karl  
 Lassalle, F.  
 Engels, F.  
 Internationale  
 Weitling, W.  
 Liebknecht, K.  
 Liebknecht, W.  
 Gronlund, L.  
 Bellamy, E.  
 Bebel, F. A.  
 Vollmar, G. H.  
 Bernstein, E.  
 Malon, B.  
 Godin, J. B. A.  
 James, E. J.  
 Millerand, A.  
 Jaures, J. L.  
 Briand, A.  
 Gronlund, Lawrence  
 Morris, Wm.  
 Hyndman, H. M.  
 Fabian Society  
 Webb, S.  
 Kelly, E.  
 Loria, A.  
 Wagner, A.  
 Schmoller, G.  
 Shaw, G. B.  
 Nieuwenhuis, D.  
 Sabotage

(d) For Anarchism, see:

Anarchist  
 Bakunin, M.  
 Godwin, William  
 Proudhon, P. J.

Tucker, B. R.

Hess, Moses

Syndicalism

Industrial Workers of the World

Ferrer

Most, Johann

Nihilism

Michel, Louise

(e) For quasi-socialistic movements,  
see:

(a) Municipal Ownership

Single Tax

George, Henry

(b) Coöperation

Rochdale Pioneers

Consumers' League

Profit Sharing

Leclaire, E. J.

7. Socialism is heterodox in exalting the State over the individual, yet there is rapidly growing recognition of the right of the State to intervene for the protection of the working classes, and to assume functions tending to further their welfare. See:

Factory Inspection

Labor Legislation

Employers' Liability

Employment Bureau

Social Insurance

Labor Church

Labor Colonies

Labor Congresses

Labor Day

Labor Organizations

Labor Party

Labor Problems

Labor Exchange

Child Labor

Sweating System

Lodging Houses

Housing Problem

Tenement House Problem  
 Bath Houses, Municipal  
 Postal Savings Banks  
 Old Age Pensions  
 Vacant Lot Farming

8. A recent development of social work is the settlement house established in the congested district of great cities to act as a centre of physical and moral uplifting. See:

Social Settlements  
 People's Palace  
 Toynbee, Arnold  
 Hull House  
 Addams, Jane  
 Boys' Clubs  
 Fresh-Air Work  
 George Junior Republic

See also: Salvation Army; Booth, Charles; Pullman; Krupp Foundries, Social Work at; Y. M. C. A.; Y. W. C. A.

9. For a problem specifically American, see:

Negro in America  
 Negro Education  
 Hampton Normal and Agricultural Institute  
 Tuskegee Normal and Industrial Institute  
 Washington, Booker T.

Societies in the narrow sense, associations, that is, of individuals, for the attainment of a common aim, have always existed, illustrating in the miniature the gregarious nature of man. Their purpose may be various, social, political, religious, educational, or protective. See for types of each:

Societies  
 Club  
 Benefit Societies

Friendly Society  
 Building and Loan Associations  
 Secret Associations  
 Burschenschaft  
 Carbonari  
 Mafia  
 Camorra  
 Fenian Society  
 Patriotic Societies  
 Orders  
 Templars, Knights  
 Hospitalers  
 Brotherhoods, Religious  
 Jesuits  
 Societies for Ethical Culture  
 Fraternities, American College Academy  
 Institute of France  
 Royal Society  
 Historical Associations, American  
 Masons, Free  
 Odd Fellows, Independent Order of  
 Pythias, Knights of  
 Elks, Benevolent and Protective Order of  
 Hibernians, Ancient Order of  
 Industrial Workers of the World

10. A partial list only of writers and investigators in sociology would include:

Addams, Jane  
 Althusius, Johannes  
 Ammon, Otto  
 Angell, George Thorndike  
 Appert, B. N. M.  
 Barth, Paul  
 Barton, Clara  
 Baxter, Robert D.  
 Bebel, F. A.  
 Birkbeck, George  
 Bodin, Jean  
 Booth, Charles  
 Buckle, Henry T.

- |                            |                          |
|----------------------------|--------------------------|
| Burdett-Coutts, A. G.      | Lassalle, Ferdinand      |
| Burdett-Coutts, W. L. A.B. | Le Bon, G.               |
| Buxton, Sir Thomas F.      | Le Play, P. G. F.        |
| Considérant, V. P.         | Liebknecht, K.           |
| Cooper, Peter              | Liebknecht, W.           |
| Coram, Thomas              | Livermore, M. A.         |
| Crandall, Prudence         | Lloyd, Henry D.          |
| Darling, Grace             | Mathew, Theobald         |
| Durkheim, E.               | Montefiore, Sir Moses H. |
| Enfantin, B. P.            | Montyon, A. J. B.        |
| Fairbanks, Arthur          | Moon, William            |
| Faithfull, Emily           | Mott, Lucretia           |
| Folks, Homer               | Neale, Edward V.         |
| Fourier, François C. M.    | Pinkerton, Allen         |
| Fry, Elizabeth             | Rowton, M. W. L.         |
| Galton, Sir Francis        | Sadler, M. T.            |
| Giddings, F. H.            | Schäffle, A.             |
| Girard, Stephen            | Schulze-Delitzsch, H.    |
| Godin, Jean B. A.          | Seligman, E. R. A.       |
| Gompers, Samuel            | Sharp, Granville         |
| Gumplowicz, Ludwig         | Smith, Gerrit            |
| Gurney, J. J.              | Stuckenberg, J.          |
| Guy, Thomas                | Tarde, G.                |
| Hanway, Jonas              | Torrens, W. T. McC.      |
| Henderson, C. R.           | Toynbee, Arnold          |
| Hill, Octavia              | Ward, Lester F.          |
| Hill, Sir Rowland          | Waugh, Benjamin          |
| Hobhouse, L. T.            | Webb, Sidney             |
| Holyoake, G. J.            | Willard, Frances E.      |
| Howard, John               | Wines, F. H.             |
| Kidd, Benjamin             | Worms, René              |
| Kyrle, John                |                          |

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# Chapter 4. Political Economy

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## Political Economy

Political Economy has been briefly defined as the science of wealth, but this definition requires a further explanation of the peculiar sense in which the term wealth is employed. Wealth has been defined as the body of things that have value, but here again value in the economic sense has a narrower meaning than in ordinary use. Value, in economic discussion, usually means power in exchange, that is, the power of a commodity to command other commodities in exchange. Such attempts at brief definition, however, are not satisfactory, since each primary concept of the science is itself the text for long discussion. The best introduction to the subject will be found in the article, **POLITICAL ECONOMY**, which outlines clearly the content or scope, the relation of political economy to other branches of study, and the methods of investigation or arrangement that it employs.

I. The fundamental principles should then be studied by reference to the following articles:

Wealth  
Production  
Labor  
Division of Labor  
Industrialism  
Wages  
Money  
Bank, Banking  
Standard of Living  
Capital  
Interest  
Usury  
Rent

Tax  
Single Tax  
Métayer  
Profit  
Monopoly  
Speculation  
Consumption  
Value  
Coöperation  
Distribution  
Exchange  
Tariff

The history of economic thought should be studied next. In ancient and mediæval times political economy was not marked off from other branches of learning, and no attempt was made to study it systematically. From the historical paragraphs in the article, **POLITICAL ECONOMY**, it will be seen that to the Greek and Roman philosophers, as well as to the mediæval churchmen, the laws of trade were of interest mainly in their moral bearings. Even in the eighteenth century, when some of its principles were understood, and something like a systematic study was attempted, its scope and importance were not realized. It was regarded as a branch of statecraft. Not private wealth, but the best means of increasing financial power of the state was the main object of investigation. For an account of the various systems of economic thought, and the contributions of individual economists, see the following:

Mercantilism  
Physiocrats  
Laissez-Faire

Manchester School  
 Free Trade  
 New Freedom  
 Open Door  
 International Trade  
 Protection  
 Balance of Trade  
 Navigation Laws  
 Tariff  
 Quesnay, F.  
 Smith, Adam  
 Ricardo, D.  
 Malthus, T. R.  
 Thünen, J. H. von  
 Say, J. B.  
 Carey, H. C.  
 Bastiat, F.  
 Mill, J. S.  
 Cairnes, J.  
 Jevons, W. S.  
 Walker, F. A.  
 Marshall, Alfred  
 Boehm von Bawerk, E.  
 Clark, J. B.  
 Wagner, Adolf  
 Schmoller, G.  
 Menger, K.  
 Nicholson, J. S.  
 Patten, S. N.

Obviously the study of past economic conditions is essential to an understanding of the present. On the general subject of Industrial Evolution consult the following:

Manufactures  
 House Industry  
 Mir  
 Guild  
 Hanseatic League  
 Merchants Adventurers  
 Mercantilism  
 Physiocrats  
 Industrial Revolution

Factories and the Factory System  
 Cartwright, E.  
 Open Field System  
 Agriculture  
 Hargreaves, J.  
 Arkwright, Sir R.  
 Crompton, Samuel  
 Watt, James  
 Whitney, Eli  
 Spinning  
 Weaving  
 Wool  
 Cotton  
 Loom  
 Textile Manufacturing  
 Eight-Hour Day

(See UNITED STATES, GREAT BRITAIN, GERMANY, etc., for economic evolution of those countries.)

II. Reading the above topics in the order given will have supplied the theoretical and historical basis for the study of actual conditions, practical questions, and proposed measures of reform, which are arranged logically in the following lists:

#### 1. TRADE AND TRANSPORTATION:

Commerce  
 Barter  
 Chamber of Commerce  
 Imports and Exports  
 Demand and Supply  
 Exchange  
 Foreign Money  
 Ad Valorem  
 Coasting Trade  
 Competition  
 International Trade  
 Balance of Trade  
 Stock Exchange  
 Bond  
 Stock

Bucket Shop  
 Customs Duties  
 Lloyds  
 Underwriter  
 Crisis, Economic  
 Speculation  
 Transportation  
 Railways  
 Express Company  
 Baggage  
 Commerce Court  
 Treaty  
 Commercial Treaties  
 Reciprocity  
 Tariff  
 Geography, Economic  
 Mercantile Agency  
 Port of Entry  
 Pooling  
 Labor and Commerce, Department  
 of  
 Municipal Ownership

See also statistics of Commerce and  
 Railways under the various countries,  
 as UNITED STATES, GREAT BRITAIN,  
 CHILE, etc.

## 2. LABOR AND CAPITAL:

Trade Unions  
 Labor  
 Capital  
 Labor and Capital, Relations of  
 Socialism  
 Communism  
 Anarchism  
 Political Economy  
 Division of Labor  
 Labor Organizations  
 Knights of Labor  
 Labor, American Federation of  
 Industrial Workers of the World  
 Wages  
 Minimum Wage  
 Labor Union, The American

Railway Brotherhoods  
 Typographical Union of North  
 America  
 Letter Carriers, National Associa-  
 tion of  
 Metal Trades Association  
 Miners, Western Federation of  
 Mine Workers of America  
 Labor Representation Committee  
 Labor Party, British  
 Manufactures  
 Strikes and Lockouts  
 Industrial Arbitration and Concilia-  
 tion  
 Sabotage  
 Syndicalism  
 Eight-Hour Day  
 Standard of Living  
 Union Label  
 Interlocking Directorates  
 Boycotting  
 Lockout  
 Picketing  
 Labor Problems  
 Labor Colonies  
 Labor Congresses  
 Contract Labor Law  
 Labor Day  
 Labor Legislation  
 Labor, Department of  
 Labor Church  
 Industrial Revolution  
 Sweating System  
 Employment Bureau  
 Labor Exchanges  
 Labor, Bureaus of  
 Child Labor  
 Employers' Liability  
 Workingmen's Compensation  
 Accidents, Industrial  
 Factory Inspection  
 Social Democracy  
 Shops  
 Injunction

### 3. GOVERNMENTAL REGULATION AND ENCOURAGEMENT OF COMMERCE AND INDUSTRY:

Protection  
 Customs Duties  
 Tariff  
 Drawback  
 Warehousing System  
 Mercantilism  
 Industrial Commission  
 Latin Union  
 Hamilton, Alexander  
 List, Friedrich  
 Balance of Trade  
 Corn Laws  
 Anti-Corn-Law League  
 Cobden Club  
 Reciprocity  
 Shipping Subsidies  
 Coasting Trade  
 Monopoly  
 Trusts  
 Trust Fund Doctrine

### 4. MONEY AND CREDIT:

Money  
 Precious Metals  
 Foreign Money  
 Bullion  
 Coinage  
 Numismatics  
 Index Numbers  
 Tabular Standard  
 Bimetallism  
 Latin Union  
 Monetary Conferences  
 Monetary Commission  
 Gresham, Sir Thomas  
 Gresham's Law  
 Greenbacks  
 Currency  
 Greenback Party  
 Specie Payments, Suspension and Resumption of

Fiat Money  
 Credit  
 Credit, Letter of  
 Crisis, Economic  
 Interest  
 Bank, Banking  
 Land Banks  
 Clearing-House  
 Trust Companies  
 Bill of Exchange  
 Exchequer Bills  
 Crédit Foncier  
 Mortgage Banks  
 Rural Credit  
 Reserve Bank, Federal

### 5. TAXATION AND FINANCE:

Finance  
 Tax, Taxation  
 Debt, Public  
 Independent Treasury  
 Repudiation  
 Tariff  
 Customs Duties  
 Excise  
 Internal Revenue System  
 Budget  
 Income Tax  
 Land Tax  
 Special Assessment  
 Single Tax

See also sections on *Finance* under the various countries, as UNITED STATES, GREAT BRITAIN, BRAZIL, etc.

### 6. INSURANCE AND SAVINGS INSTITUTIONS:

Insurance  
 Life Insurance  
 Fraternal Insurance  
 Fire Insurance  
 Marine Insurance  
 Friendly Societies  
 Workingmen's Insurance

Tontine  
Underwriter  
Annuity  
Savings Banks  
Post Office Savings Bank  
Trust Companies  
Building and Loan Associations

7. AMONG PROMINENT ECONOMISTS,  
in addition to those already named in  
the lists, are the following:

Achenwall, Gottfried  
Adams, H. C.  
Aguado, A. M.  
Anderson, James  
Ashley, W. J.  
Astor, John Jacob  
Atkinson, Edward  
Bagehot, Walter  
Baring  
Baring, A.  
Bastable, C. F.  
Bastiat, F.  
Bates, Joshua  
Baudrillart, H. J. L.  
Baxter, Robert D.  
Beckmann, Johann  
Bemis, Edward W.  
Biddle, Nicholas  
Blanqui, J. A.  
Block, Maurice  
Bodin, Jean  
Boehm von Bawerk, E.  
Boisguilbert, P. le P.  
Brentano, L. J.  
Cairnes, John E.  
Carey, Henry C.  
Carli, G. R.  
Cernuschi, Henri  
Chevalier, M.  
Child, Sir Josiah  
Clark, John B.  
Cobden, Richard  
Cohn, Gustav

Cooke, Jay  
Cossa, Luigi  
Courcelle-Seneuil, J. G.  
Cournot, A. A.  
Decker, Sir Matthew  
Dewey, Davis R.  
Drexel, Anthony J.  
Ely, Richard T.  
Engel, Ernst  
Farr, William  
Farrer, T. H.  
Faucher, J.  
Fawcett, Henry  
Ferraris, C. F.  
Field, Cyrus F.  
Fisher, I.  
Fisk, James  
Fix, Théodore  
Frick, H. C.  
Gage, L. J.  
Galiani, F.  
Garnier, J. C.  
Genovesi, A.  
Giffen, Sir Robert  
Gioja, M.  
Giovanitti, A. M.  
Girard, Stephen  
Glass, Carter  
Gould (family)  
Gournay, J. C. M. V.  
Hadley, A. T.  
Hamilton, Robert  
Harriman, Edward H.  
Haxthausen, A.  
Hermann, F. B. W.  
Hewitt, A. S.  
Hill, James J.  
Hobson, J. A.  
Horner, F.  
Horton, S. D.  
Howe, S. G.  
Hudson, G.  
Hufeland, G.  
Ingram, J. K.



Jenks, J. W.  
 Jevons, W. S.  
 Kay, Joseph  
 King, Wm. L. M.  
 Knox, J. J.  
 Laing, S.  
 Laughlin, J. L.  
 Laveleye, Emile  
 Law, John  
 Le Play, P. G. F.  
 Leroy-Beaulieu  
 Leslie, T. E. C.  
 Levasseur, E.  
 Levi, Leone  
 List, F.  
 Loria, A.  
 McCulloch, J. R.  
 Mackay, C. W.  
 Macleod, H. D.  
 Malthus, T. R.  
 Marshall, A.  
 Mayo-Smith, R.  
 Menger, Karl  
 Morgan, J. P.  
 Mun, Thomas  
 Necker, Jacques  
 Newmarch, William  
 Nicholson, J. S.  
 North, Sir Dudley  
 Oncken, August  
 Overstone, S. J. L.  
 Parien, M. L. P. F. E.  
 Paterson, Wm.  
 Peabody, G.  
 Pender, Sir John

Petty, Sir William  
 Price, Richard  
 Quesnay, F.  
 Raiffeisen, F. W.  
 Rau, K. H.  
 Rogers, J. E. T.  
 Roscher, W. G. F.  
 Rothschild  
 Say, J. B.  
 Say, L.  
 Schäffle, A. E. F.  
 Schmoller, G.  
 Schulze-Delitzsch, F. H.  
 Seebohm, F.  
 Seligman, E. R. A.  
 Senior, N. W.  
 Soetbeer, A.  
 Sumner, W. G.  
 Taussig, F. W.  
 Tooke, Thomas  
 Torrens, Robert  
 Tucker, Josiah  
 Vanderbilt (family)  
 Wagner, Adolf  
 Wagner, H.  
 Walker, F. A.  
 Walker, R. J.  
 Walrus, M. E. L.  
 Watkin, Sir E. W.  
 Wells, D. A.  
 Wolowski, L. F. M. R.

8. FOR ECONOMIC AND SOCIAL RE-  
 FORM MOVEMENTS, see section 6 of  
 the preceding division (Sociology).

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## Chapter 5. Anthropology

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**T**AKEN in its broadest signification, Anthropology, the science of Man, would include within its scope all the sciences and arts as dealing with particular phases only of the history of human life on earth. Physiology, Psychology, Philosophy, Linguistics and Literature would then be proper fields of study for the anthropologist, as to a large extent they are. But the field of human knowledge is so broad, and the scope of every particular science in fact so extensive, that in the nature of things no single mind can at the present day carry on the work of scientific investigation in more than a limited field of inquiry. Practically, therefore, anthropology, with its allied science of ethnology, has become the study of a man as a zoölogical genus, and secondly, the study of the origins of culture as deduced from ancient remains and the testimony afforded by surviving savage races whose life has as yet undergone no such differentiation as to put it beyond the study of a single mind. Among them are sought the germs of present institutions and beliefs, which are followed up until they become the things of which history takes cognizance. Primitive life, then, is largely the subject of anthropology which deals also with survivals of primitive modes of life and methods of thought in our own times. Thus the topic of Folklore and Customs falls fairly within its field. See:

Man, Science of  
Anthropology  
Ethnography

1. The study of human anatomy and physiology is of primary importance in the science of man. On the basis of morphological and physiological peculiarities, various classifications of mankind have been made, and our knowledge of prehistoric man is largely a matter of skulls and thigh bones. The measurement of the human body has become a science in itself. See:

Somatology  
Cranimetry  
Skin  
Mongolian Spots  
Anthropometry  
Melanism and Albinism  
Hair  
Giants

Dwarf  
Skull

2. Remains of prehistoric man have been found in both hemispheres, but most plentifully in Europe. Ingenious comparative studies allow us to arrive at a fair conception of the physical characteristics of the earliest inhabitants of the world. See:

Barrow  
Mound-Builders  
Megalithic Monuments  
Dolmen  
Avebury  
Stonchenge  
Spy  
Chelléan  
Cro-Magnon  
Furfooz Race  
Hallstatt Epoch  
Madeleine, La

Mousterian Epoch  
 Neanderthal Man  
 Lansing Man  
 Kitchen-Midden

3. For the great divisions of mankind determined on the basis of physical characteristics and geographical distribution, see:

Caucasian Race  
 Europe, Peoples of  
 Mediterranean Race  
 Mongolian Race  
 Negro  
 Indian Peoples  
 Malayan Peoples  
 Melanesians  
 Indians, American  
 Mixed Races

4. On the question of the origin of mankind there has been much disputation among anthropologists with little positive results. See:

Evolution  
 Pithecanthropus

5. Man has nowhere been found in complete isolation. From the first he appears as the social being with his life conditioned by the co-existence of others of his kind. Co-existence meant likeness of thought and experience and the necessity of intercommunication. Our interest, therefore, turns to language. See:

Language  
 Philology  
 Gesture Language  
 Sign Language  
 Writing  
 Hieroglyphics  
 Cuneiform Inscriptions  
 Wampum

6. In common with the animals

man is early engaged in a struggle for the material needs of existence, with greater needs to satisfy, however, than the animals, and consequently with growing resources.

(a) The desire for food is the primal motive in life. See:

Cannibalism  
 Geophagy  
 Cookery  
 Pottery

(b) According to the nature of the physical conditions amidst which he dwelt, man found shelter for himself. See:

Tent  
 Wigwam  
 Cave-Dwellers  
 Cliff-Dweller  
 Mesa  
 Earth Lodge  
 Lake Dwellings  
 Archaeology, American  
 Casa Grande  
 Oaxaca, Ruins of  
 Palenque  
 Nomad  
 Gypsies

(c) Dress, it is well established, came from no need of protecting the body, but had its origin in ornament. See:

Dress  
 Tattooing  
 Headdress  
 Hairdressing

7. Man entered upon a rapid course of development when, in his search for sustenance and shelter, he began the use of tools. See:

(a) For Implements:  
 Flint Implements

Celt  
Stone Age  
Bronze, Age of  
Archæology, American  
Paleolithic Period

(b) For Weapons:

Arrow  
Blowgun  
Tomahawk  
Boomerang  
Scalping

For the beginnings of the agricultural stage, see:

Agriculture  
Plow  
Domestic Animals

8. The religion of primitive man is essentially the belief in a universally animated world, a world of spirits, to combat and placate whom is the business of his life. See:

Animism  
Totemism  
Superstition  
Religion, Comparative  
Magic  
Necromancy  
Oracle  
Nature-Worship  
Fire-Worship  
Phallicism  
Fetishism  
Shamanism  
Amulet  
Manitou  
Demonology  
Demoniac  
Satanism  
Voodoo  
Ghosts  
Fast  
Sacrifice

9. Birth and death are naturally portentous phenomena to the primitive mind, and are marked, death especially, by various ceremonies. In case of death the rites connect themselves with the belief in existence beyond the grave. See:

Couvade  
Circumcision  
Teknonymy  
Infanticide  
Mortuary Customs  
Burial  
Cist-burial  
Suttee  
Coffin

10. The origin of the family relation is a subject of much controversy; and the older view that, preceding the present organization of the family under the authority of the father and conditioned by the element of property, mankind passed through a stage in which the family centered around the mother, in whom authority was vested, and from whom descent was traced has been abandoned. See:

Marriage  
Matriarchate  
Partriarchate  
Polygamy  
Polyandry  
Levirate Marriage  
Clan  
Tribe  
Totemism  
Caste  
Exogamy  
Miscegenation  
Slavery

11. Primitive morality is often regarded as utilitarian and narrow in the scope of its application; but a

great deal of data has accumulated to negate this interpretation: In primitive life the social group is independent politically and, hence, frequently hostile with its neighbors, but this is not essentially different from civilized governments. Internally each of these primitive groups is governed by a legal code. Primitive law is summed up in custom. See:

Law  
Custom  
Taboo

12. Energy not directed towards the direct satisfaction of material wants finds expression among savages in games and sports. *Æsthetics*, modern research goes to show, had its origin in play. See:

Art, Primitive  
*Æsthetics*  
Swastika  
Festivals  
Dancing  
Corroboree  
Sun Dance  
Snake Dance  
Music  
Areois  
Potlatch

13. The survival of primitive thought in custom, legend, superstition, and common practices shows how continuous is the line of development from the mental life of primitive man to our own. For the entire subject of folk lore, see:

Folklore  
Nursery Lore  
Nursery Rhymes  
Superstition  
Magic

Witchcraft  
Incantation  
Vampire  
Werwolf  
Griffin  
Dragon  
Unicorn  
Mermaid  
Fairy  
Morgan, the Fay  
Avalon  
Goblins  
Oberon  
Puck  
Robin Goodfellow  
Baring-Gould, S.

14. The data of anthropology have been collected from many sources, and the outline of the principles of the science may be filled in with concrete detail, by referring to the many descriptive articles on the primitive peoples. Of the most interesting primitive groups for the anthropologists, a partial list would be the following:

(a) For America, see **INDIANS**, **AMERICAN**, an elaborate study which may be carried into great detail by following out the cross references to every tribe of North, Central, and South America. See also **ESKIMO**.

(b) For Asia:

Philippine Islands  
Aino  
Andamanese (under Andamans)  
Sundanese (under Sunda Islands)  
Dyak  
Gonds  
Gurkhas  
Khonds

Karens  
 Mois  
 Miao-Tse  
 Shans  
 Thai  
 Todas  
 Veddas  
 Baluchis (under Baluchistan)  
 Bhil  
 Bedouin  
 Kurds  
 Buriats  
 Giliaks  
 Kalmucks  
 Golds  
 Kirghiz  
 Koriaks  
 Ossetes  
 Tchuktchi  
 Tchuvashes  
 Tatars  
 Ugrians  
 Uzbeks  
 Vedahs  
 Yakuts  
 Yukagirs  
 Malayan Peoples  
 Polynesians  
 Melanesians  
 Micronesians  
 Negritos

(c) For Africa:

Akka  
 Bantu  
 Bejas  
 Berber  
 Kabyles  
 Bushmen  
 Hottentots  
 Kafirs  
 Dinka  
 Fellah  
 Masai

Hausa (under Hausa States)  
 Niam Niam  
 Somali  
 Yolof  
 Yoruba  
 Zulus (under Zululand)

(d) For Australasia:

Australians (under Australia)  
 Maoris  
 Tasmanians (under Tasmania)

(e) For Europe:

Europe, Peoples of  
 Basque Race  
 Gypsies  
 Lapps (under Lapland)

15. A partial list of well-known anthropologists would include the following names:

Andre, R.  
 Bandelier, A. F. A.  
 Bastian, A.  
 Beauchamp, W. M.  
 Berendt, K. H.  
 Boas, F.  
 Brinton, D. G.  
 Broca, P.  
 Catlin, G.  
 Cushing, F. H.  
 Faidherbe, L. L. C.  
 Flower, W. H.  
 Fritsch, G. T.  
 Furness, W. H.  
 Gatschet, A. S.  
 Haddon, A. C.  
 Hale, H.  
 Hartmann, R.  
 Hodge, F. W.  
 Holmes, W. H.  
 Kanitz, F. P.  
 Kroeber, A. L.  
 Laufer, B.

Lubbock, J.  
McCurdy, J. F.  
McGee, W. J.  
McLennan, J. F.  
Mallery, G.  
Mantegazza, P.  
Mason, O. T.  
Mooney, J.  
Morgan, Jacques de  
Morgan, L. H.  
Mortillet, L. L.  
Pilling, J. C.  
Powell, J. W.  
Prichard, J. C.

Putnam, F. W.  
Quartrefages, J. L. A.  
Ranke, J.  
Ratzel, F.  
Reinach, S.  
Ripley, W. Z.  
Rivers, W. H. R.  
Schoolcraft, H. R.  
Sergi, G.  
Smith, Buckingham  
Squier, E. G.  
Topinard, P.  
Tylor, E. B.  
Ujfalvy, C. E.

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## Chapter 6. Religion

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**O**F THE numerous classifications of religion, none of which is free from many serious objections, we may adopt as the most practical that which divides creeds into monotheistic and non-monotheistic; and though here, too, we are confronted by the difficulty that certain faiths are neither one nor the other, completely, we may apply the former term to the three great religions of Judaism, Christianity, and Mohammedanism, and classify under the second heading all beliefs whatsoever, from primitive animism through the various national mythologies to the great moral and philosophic systems of the East. The starting point should be the comprehensive article on RELIGION, COMPARATIVE. The subject may be then pursued through such general articles as BELIEF, WORSHIP, RITE, PRAYER, SACRIFICE, PRIEST, etc. Additional titles, in great number, will naturally suggest themselves to the reader. The field, indeed, is extensive and touches intimately on the domains of Anthropology, Psychology, Philosophy, and History. This will be found especially true in the religions of the East, where philosophy and mythology or religion are practically one.

### A. Polytheistic Religions

1. The beginnings of religion, as studied in the beliefs of primitive races, will be found treated in the chapter on Anthropology, where appear such titles as

Man, Science of  
Nature-Worship  
Fetishism, etc.

The subject is carried on in the special articles dealing with individual tribes and nations, of which a list appears in the same chapter.

2. The religions and mythologies of the Babylonia, Assyria, Egypt, Greece, and Rome are discussed in the chapter on History, in the various sections devoted to those countries. The intimate connection of the religions and the political life in the ancient world has made this division seem desirable.

3. The mythology of the Scandinavian and Teutonic races differs from

that of Greece in its pervading atmosphere of gloom and the foreboding of fate. The northern divinities lack the joyous grace and humanity of the Olympian pantheon, and the powers of darkness, cold, and death play a far more conspicuous part. See:

Mythology  
Polytheism  
Scandinavian and Teutonic Mythology  
Edda  
Aesir  
Asgard  
Bifröst  
Yggdrasil  
Mimir  
Norns  
Odin  
Tyr  
Thor  
Bragi



Balder  
Loki  
Freyja and Frigga  
Ragnarök  
Fenrir  
Walhalla  
Hel  
Niflheim

4. We leave pure polytheism in passing to the great religions of India. It, there, evolves with time into complex systems of mythology modified by pantheism and agnosticism.

(a) BRAHMANISM.

Brahmanism may go back to the second millennium before the Christian era, and comprises the mass of beliefs and institutions originated or elaborated from a primitive nature-worship, by the Brahmans, who constitute the dominant class among the Hindus. It is essentially a legislative system, with a vast and minutely outlined ceremonial. In its later development, it is characterized by pantheism, the doctrine of Karma, and metempsychosis. See:

Brahmanism  
Aryan  
Veda  
Brahmana  
Upanishad  
Manu  
Brahma  
Varuna  
Agni  
Indra  
Ushas  
Maruts  
Pitris  
Sankhya  
Nyaya  
Vēdānta

Mahabharata  
Rāmāyana  
Vishnu  
Śiva  
Krishna  
Purāna  
Tantra  
Vaishnavas  
Śaivas  
Śāktas  
Pārvatī  
Kali  
Lakshmi  
Hanumān  
Ganesa  
Śraddha  
Caste  
Henotheism  
Karma  
Metempsychosis  
Theosophy  
Sikhs

(b) BUDDHISM.

Buddhism antedates Christianity in its origin, and its adherents are second in number only to those of the Christian faith. Taking its rise in Hindustan, it has spread over China, Indo-China, Japan, Tibet, and the plains of Northern and Central Asia. In that continent, its mission as a bearer of civilization and morality has been not unlike the rôle played by Christianity in Europe and America. See:

Buddhism  
Pitaka  
Asoka  
Metempsychosis  
Karma  
Nirvana  
Śravaka  
Shin-Shu  
Bonze

For a Variant of Buddhism, see

Lamaism

And, for an Allied Creed, see

Jainism

See also Brahmanism, above.

#### 5. ZOROASTRIANISM.

In the great religion of Iran, we may find the earliest traces of primitive Aryan belief. Zoroastrianism is important for the influence it exercised on Judaism and Christianity, to which it contributed the great dualistic principle of the conflict between good and evil. See:

Zoroastrianism

Zoroaster

Avesta

Gâthâs

Pahlavi Language and Literature

Magi

Parsis

Ghebers

Ormazd

Ahriman

Mithras

Asmodeus

Saoshyant

6. The prevailing religion in China and Japan is Buddhism. The native religious systems of China are in reality moral philosophies. In Japan, however, we find a peculiarly national religion, influenced to some extent by Chinese and Buddhistic elements. See:

(a) Confucius

Mencius

Chu-Hi

(b) Taoism

Lao-tse

(c) Shintō

Kōbō Daishi

Fox-deity

Bushido

## B. Monotheistic Religions

### I. JUDAISM.

The history of the Jewish people, who claimed to be the nation specially favored of the One God, and the sole depository of His revelation, will be largely found in the historical chapter of this book; but here a few further indications may be given of some of their peculiar institutions. Their worship, in its earlier form, is described under TABERNACLE, then under TEMPLE, and in a special section of the article SACRIFICE, and a still later development is treated under SYNAGOGUE.

Special observances at particular seasons are treated under:

Passover

Purim

Atonement, Day of

Pentecost

Dedication Feast

Weeks, Feast of

Tabernacles, Feast of

Sabbath

Jubilee, Year of

On their sacred writings, besides the articles on each book of the Old Testament, see:

Talmud

Targum

Midrash

Gemara

Mishna

The functionaries of their religion and justice come under:

Priest  
 High Priest  
 Levite  
 Scribe  
 Rabbi  
 Sanhedrin

Other characteristic customs and usages:

Circumcision  
 Tithes  
 Uncion  
 Proselyte  
 Urim and Thummim  
 Phylactery

The sects and parties which developed in course of time among the race are detailed under JEWISH SECTS, and specially in the following articles:

Pharisees  
 Sadducees  
 Essenes  
 Chasidim  
 Frank, Jacob

## II. CHRISTIANITY.

1. FOUNDATIONS. The history of Christianity is so diversified, and so intimately bound up with the development of European civilization, that a large amount of space is necessarily accorded to it. The most convenient division will begin with the foundations, including under that head the articles centring around its Founder and the history and worthies of the first few centuries of the Christian era, before Europe was submerged in the chaos which resulted from the barbarian invasions. See:

Christianity  
 Creeds and Confessions  
 Fundamentals of Christian Doctrine  
 Development of Doctrine

God  
 Jesus Christ  
 Incarnation  
 Hypostatic Union  
 Atonement  
 Intercession, Doctrine of  
 Resurrection  
 Miracles  
 Holy Ghost  
 Filioque  
 Trinity, Doctrine of the  
 Nicene Creed  
 Prayer  
 Providence  
 Predestination  
 Foreknowledge and Foreordination  
 Sin  
 Original Sin

Besides the article under the title ESCHATOLOGY, several others which follow deal with the problems which have so exercised the mind of man as to his ultimate destination after the short period of life in this world. See:

Immortality  
 Judgment, Final  
 Millennium  
 Second Advent of Christ  
 Apocalyptic Literature  
 Antichrist  
 Annihilationism  
 Heaven  
 Beatific Vision  
 Hell  
 Probation after Death  
 Purgatory  
 Limbus

The following articles deal with the organizations by whose means the religion of Christ was spread throughout the world, and with early records of its faith and practice:

Church

Council  
 Synod  
 Missions, Christian  
 Apostle  
 Doctors of the Church  
 Fathers of the Church  
 Persecutions of the Christians  
 Lapsed  
 Catechumens  
 Disciplina Arcani  
 Agapæ  
 Teaching of the Twelve Apostles  
 Apostolic Constitutions  
 Apostolic Fathers  
 Jerusalem, Councils of  
 Nicæa, Councils of  
 Constantinople, Councils of  
 Ephesus, Councils of  
 Council of Chalcedon (under Chalcedon)  
 For the great figures of the period of foundation and dissemination, see:  
 Mary  
 Joseph  
 John the Baptist  
 Peter  
 Paul  
 John  
 James  
 Philip  
 Bartholomew  
 Thomas  
 Andrew  
 Jude  
 Barnabas  
 Matthias  
 Mark  
 Luke  
 Mary Magdalene  
 Timothy  
 Titus  
 Stephen  
 Justin Martyr  
 Ignatius

Irenæus  
 Polycarp  
 Agnes  
 Agatha  
 Alban  
 Apollos  
 Athanasius  
 Arius  
 Augustine  
 Barbara  
 Basil  
 Boniface  
 Cassianus, Johannes  
 Cecilia  
 Chrysostom  
 Cyprianus  
 Cyril of Alexandria  
 Cyril of Jerusalem  
 Denis  
 Dionysius  
 Ephraem  
 Epiphanius  
 Eusebius  
 Felicitas  
 Fortunatus, Venantius  
 Gregory of Nazianzus  
 Gregory of Nyssa  
 Gregory Thaumaturgus  
 Gregory of Tours  
 Hilary  
 Hippolytus  
 Hosius  
 Isidore of Seville  
 Jerome  
 Lawrence  
 Martin of Tours  
 Patrick  
 Prudentius, Aurelius Clemens  
 Theodore of Mopsuestia

## 2. EARLY SECTS AND HERESIES.

No sooner had the Christian Church been fully organized and entered upon its mission of converting, than the infinite diversity of human minds im-

pelled different men to emphasize disproportionately some one aspect of the faith which all at first held in common. This was especially the case during the first three centuries, while Christianity had its chief stronghold in the East, the speculative and dialectical minds of whose people were naturally inclined to minute questions of abstract theology. The heresies which took their rise in the West were of a more practical kind, dealing, like Montanism, with the severity of discipline, or, like Pelagianism, with the freedom of the human will. Those who wish to trace the abstruse questions which threatened to divide the Church even before it had emerged from the shadow of persecution, may consult especially the following articles:

Adiaphorists  
 Adoptian Controversy  
 Arius  
 Aëtius  
 Agnoetæ  
 Alogians  
 Apollinaris  
 Celsus  
 Cerdonians  
 Cerinthus  
 Docetæ  
 Donatists  
 Dositheans  
 Ebionites  
 Elkesaites  
 Eutyches  
 Gnosticism  
 Hesychasts  
 Iconoclasm  
 Macedonians  
 Manichæism  
 Monarchians  
 Monophysites  
 Monothelitism

Montanus  
 Nestorians  
 Nicolaitans  
 Novatian  
 Origen  
 Patripassianism  
 Paulicians  
 Pelagianism  
 Sabellius  
 Semi-pelagianism  
 Valentinians  
 Vigilus

### 3. TRADITIONAL CHRISTIANITY.

The latter history of Christianity may be most conveniently divided into two main heads—according as the various Christian bodies have adhered, to a greater or less extent, to the older usages or beliefs, or have broken away from them, and evolved new ones of their own. Of these two divisions, the former is inevitably much the larger, covering a much greater extent of time and a wider range of subjects. The naturally unchanging East has been less affected by the currents of thought, and the many practical problems, which have introduced many changes or developments in the western world. The articles PAPACY, which traces the history of the central see of Christendom, down to the Council of Trent; ROMAN CATHOLIC CHURCH, which includes the subsequent history of the churches in communion with it; and GALRICAN CHURCH, give a large part of the general institutional development; and the biographies of nearly all the Popes, contain valuable indications of the policy which has at different periods guided the larger part of Christendom. The article, CHURCH HISTORY, contains an account of the principal

writers who have narrated this development; and the following articles contain detailed information on all the more important points.

(a) For Church Organization, see:

Patriarch  
Metropolitan  
Archbishop  
Bishop  
Titular Bishops  
Suffragan  
Apostolic Succession  
Orders, Holy  
Cardinal  
Conclave  
Legate  
Priest  
Rector  
Vicar  
Vicar-General  
Archdeacon  
Cathedral  
Dean  
Chapter  
Rural Dean  
Deacon  
Subdeacon  
Acolytes  
Reader  
Exorcist  
Ostiarius  
Tonsure  
Council  
Encyclical Letters  
Bull  
In Cœna Domini  
Unigenitus  
Brief, Papal  
Church Discipline  
Excommunication  
Dispensation  
Indulgence  
Inquisition

Congregation

Propaganda

Index

Commandments of the Church

Celibacy

(b) Christianity had scarcely been organized before a definite form of worship was adopted, and this became more and more fixed and uniform in its details as time went on. A great many matters of interest are contained in the history of these liturgical forms, which will be found fully given under numerous titles. See:

Worship

Liturgy

Mozarabic Liturgy

Mass

Requiem

Introit

Kyrie Eleison

Gloria in Excelsis

Collect

Epistle

Gradual

Sequence

Gospel

Offertory

Secret

Missal

Pontifical

Ritual

Processional

Canonical Hours

Breviary

Lesson

Te Deum

Magnificat

Nunc Dimittis

Miserere

De Profundis

Ave Maria

Angelus Domini

**Hymnology****Dies Iræ****Pange Lingua****Tantum Ergo****Veni Creator Spiritus****Litany****Benediction****Rosary of the Blessed Virgin Mary****Tenebræ**

(c) Under **COSTUME, ECCLESIASTICAL**, a full account will be found of the historical development of ecclesiastical vestments and their use at the present day in various parts of Christendom. A number of other articles also give details as to specific vestments and articles used in divine worship. See:

**Tiara****Pallium****Mitre****Crosier****Stole****Maniple****Surplice****Flabellum****Altar****Tabernacle****Incense****Censer****Cross****Chalice****Corporal****Agnus Dei**

(d) The Christian religion, at least in its ancient and traditional form, is essentially a sacramental one. In other words, it provides for the two-fold nature of man—body and soul—by using outward and visible signs to convey inward and spiritual grace. A large number of important subjects, accordingly, fall under the heading **Sacrament**. See:

**Sacrament****Baptism****Clinic Baptism****Heretic Baptism****Sponsors****Confirmation****Lord's Supper****Transubstantiation****Viaticum****Penance****Confession****Absolution****Orders, Holy****Marriage****Extreme Unction****Sacramentals****Holy Water****Scapular****Jubilee****Pilgrim****Stations****Image-Worship****Foot-Washing**

(e) Very early in the history of the Christian Church, special observances began to be connected with certain days—weekly, and annual commemorations of events in the life of its Founder, and anniversaries of the chief worthies who adorned its history. These are treated under:

**Sunday****Friday****Festivals****Fast****Christmas****Epiphany****Candlemas****Annunciation****Ash-Wednesday****Lent****Holy Week****Maundy Thursday**

Good Friday  
 Easter  
 Ascension Day  
 Pentecost  
 Trinity Sunday  
 Corpus Christi  
 Assumption of the Virgin Mary  
 All-Soul's Day  
 Ember-Days  
 Angel  
 Michael  
 Gabriel  
 Saint  
 Martyr  
 Canonization  
 Beatification  
 Advocatus Diaboli  
 Acta Sanctorum

(f) It is scarcely necessary to enumerate the separate books of the Bible, on which every organization of Christians professes to base its creed. Under each of their titles, the history and purport of every book may be studied, as well as the most approved conclusions of the most recent scientific criticism. Questions relating to the Bible as a whole are discussed at great length in the main article BIBLE; and reference may be made to the following subsidiary titles:

Inspiration  
 Revelation  
 Canon  
 Biblical Criticism  
 Bible Archæology  
 Textual Criticism  
 Tübingen School  
 Concordance  
 Apocrypha  
 Deuterocanonical Books  
 Bible Society  
 Bible, Curious Editions of

4. THE MONASTIC LIFE. As the civilized world, under the later Roman empire, grew more and more corrupt, the feeling gained ground that the surest way to escape from the wrath to come was to flee into the desert, and by prayer and mortification to avert the divine displeasure. The monastic life, therefore, considered as the most perfect carrying out of the counsels of Christ, took firm root in the Church. General details of its spirit and organization will be found under:

Monasticism  
 Asceticism  
 Vow  
 Monastery  
 Laura  
 Hermit  
 Recluse  
 Pillar Saint  
 Abbey  
 Abbot  
 Canon  
 Brothers, Lay  
 Brotherhoods, Religious  
 Tertiary  
 Monastic Art

The earlier monastic ideal was that of absolute separation from the world, considered as an inherently wicked place; and all the older orders, though frequently of the greatest service to society and civilization by their preservation of learning, and by their diligent labors in agriculture and the like, approach more or less the type known as cloistered orders. Of these the principal ones follow in chronological sequence, with their founders, where these have separate articles:

Antony



Paul  
 Basilian Monks  
 Augustinians  
 Benedictines  
 Benedict  
 Cluniacs  
 Camaldolites  
 Carthusians  
 Bruno  
 Chartreuse, La Grande  
 Charterhouse  
 Cistercians  
 Bernard  
 Premonstratensians  
 Gilbertines  
 Beguines  
 Carmelites  
 Servites  
 Celestines  
 Brigittines  
 Bridget  
 Ursulines  
 Angela Merici  
 Trappists  
 Rancé, Armand de

As modern society gradually became organized on more stable foundations, and men whose temperaments and habits were peaceful could be safe under its protection, another type came forward, whose fundamental idea was not retirement from the world, but an effort to sanctify it, by mingling more or less with it. Under the head of what may be called missionary communities, the following are to be noted:

Sisterhoods  
 Trinitarians  
 Franciscans  
 Francis of Assisi  
 Clares, Poor  
 Clare  
 Dominicans

Dominic  
 Minimites  
 Francis of Paola  
 Barnabites  
 Theatines  
 Capuchins  
 Jesuits  
 Ignatius of Loyola  
 Oratory, Congregation of the  
 Philip Neri  
 Oblates  
 Borromeo, Carlo  
 Piarists  
 Visitation, Sisters of the  
 Francis de Sales  
 Chantal, Jeanne Françoise  
 Lazarists  
 Vincent de Paul  
 Sulpicians  
 Olier, Jean Jacques  
 Brothers and Sisters of Charity  
 Brothers of the Christian Schools  
 La Salle, Jean Baptiste de  
 Passionists  
 Paul of the Cross  
 Redemptorists  
 Liguori, Alfonse Maria di  
 Sacred Heart, Ladies of the  
 Mercy, Fathers of  
 Paulists

5. MEDIEVAL PERIOD. The religious aspect of the Middle Ages will be found represented in nearly every article in the foregoing section; but certain others may be added which give an account of significant developments taking place within this period. Thus we have the formal organization of a whole logical system of dogmatic theology and philosophy (see SCHOLASTICISM), and of a parallel system of ethics or moral theology (see CASUISTRY). The story of the CRUSADES is of great importance, supplemented

under JERUSALEM by the history of the kingdom and patriarchate there established. The crucial controversies between Church and State which persisted throughout the Middle Ages are treated under INVESTITURE and REGALIA as well as under PAPACY. (See also in the chapter on history the section dealing with the Mediæval Ages.) Under SCHISM, WESTERN, we may follow the division within the Church caused by the pretensions of rival popes. The efforts made to secure unity of faith and discipline appear under:

- Lateran Councils
- Basel, Council of
- Ferrara-Florence, Council of
- Pisa, Council of
- Lyons, Councils of
- Inquisition
- Torquemada

The story of those who in this period broke away from that unity is told under:

- Cathari
- Fratricellians
- Albigenses
- Waldenses
- Brothers and Sisters of the Free Spirit
- Apostolic Brethren
- Lollard
- Abélard
- Berengarius of Tours
- Gottschalk
- Wiclif

Other topics of special mediæval interest are:

- Joan, Pope
- Feast of Fools
- Biblia Pauperum
- Pseudo-Isidorian Decretals

Fulda, Monastery of  
Saint Gall  
Monte Cassino

The great names in the theology, philosophy, and mysticism of the Mediæval Ages include:

- Adalbert
- Ailly, Pierre d'
- Albert, Count of Bollstädt
- Alexander of Hales
- Anselm
- Aquinas, Thomas
- Becket, Thomas à
- Bede
- Bonaventura
- Catharine of Siena (under Catharine)
- Clémanges, Nicolas de
- Columba
- Damiani, Pietro
- Duns Scotus
- Dunstan
- Eadmer
- Erigena, Johannes Scotus
- Joachim of Floris
- Kempis, Thomas à
- Lanfranc
- Lully, Raymond
- Malachy
- Occam, William of
- Peter Lombard
- Peter the Hermit
- Rabanus Maurus
- Savonarola, Girolamo
- Tauler, Johann
- Teresa, St.
- Wadding, Luke
- William of Saint-Amour
- William of Wykeham

6. THE REFORMATION PERIOD. A special section may well be devoted to the period of unrest and disruption commonly known as the Reformation.

All over Europe there was a movement, more or less general and permanent according to local circumstances, towards throwing off the authority of the Pope, simplifying faith and worship, and returning to what were assumed to be primitive beliefs and usages. See:

Reformation  
Counter-Reformation  
Utraquists  
Communion in Both Kinds  
Brethren, Bohemian  
Augsburg Confession  
Interim  
Concord, Book of  
Corpus Doctrinæ  
Magdeburg Centuries  
Epistolæ Obscurorum Virorum  
Antinomianism  
Bartholomew's, Massacre of Saint  
Dort, Synod of  
Reformed Churches  
Trent, Council of

For the Men of this Period, see:

Albert (of Magdeburg)  
Baronius, Cæsar  
Bellarmine  
Beza, Théodore  
Bucer, Martin  
Bugenhagen, Johann  
Cajetan, Thomas  
Campion, Edmund  
Calvin, John  
Canisius, Petrus  
Cano, Melchior  
Carlstadt  
Colet, John  
Eck, Johann Maier von  
Erasmus, Desiderius  
Erastus, Thomas  
Faber, Jacques  
Fisher, John  
Hamilton, Patrick

Hooper, John  
Hutten, Ulrich von  
Luther, Martin  
Melanchthon, Philip  
More, Thomas  
Œcolampadius, Johannes  
Philip the Magnanimous  
Reuchlin, Johann  
Sarpi, Paolo  
Tetzel, Johann  
Vermigli, Pietro Martire  
Wishart, George  
Zwingli, Ulrich

7. Before proceeding to a review of the Reformed Churches of modern times, the history of Eastern Christianity, separate from that of the Roman Catholic Church since 1054, may be studied under the following titles:

Greek Church  
Filioque  
Quinisext  
Photius  
Lucaris  
Nikon  
Raskolniki  
Dukhobortsy  
Molokani  
Skopty  
Stundists

## 8. MODERN REFORMED CHURCHES.

(a) ANGLICAN. The article under the title, ANGLICAN COMMUNION, explains the extent and relations of the various churches in communion with the Church of England, which represent characteristically the more conservative elements in the religion of the English-speaking races. Though as organizations they owe their origin to the great upheaval of the sixteenth century, their doctrine and usages are

largely in harmony with those which prevailed before the Reformation, and will be found treated in many instances under titles which include the ancient and modern Roman Catholic belief or practice. The following articles, however, may be consulted for specifically Anglican points:

England, Church of  
Ireland, Church of  
Episcopal Church  
Articles, The Thirty-nine  
Prayer-Book  
Homily  
Lambeth Conference  
Church Congress  
Supremacy, Royal  
Ecclesiastical Commissioners  
Vestry  
Warden, Church  
Parish  
Parish Clerk  
Lay Reader  
Advertisements of Elizabeth  
Martin Marprelate Controversy  
Savoy Conference  
Nonjurors  
Nonconformists  
Dissenters  
Act of Uniformity  
Oxford Movement  
Gorham Controversy  
Ecclesiastical Titles Assumption  
Act  
Ritualism  
Queen Anne's Bounty  
Christian Knowledge, Society  
for Promoting  
Church Temperance Society  
Brotherhood of Saint Andrew  
Daughters of the King  
Bampton Lectures  
Hulsean Lectures

Among the prominent names in the history of the Church of England in Great Britain appear:

Cranmer, Thomas  
Ridley, Nicholas  
Latimer, Hugh  
Hooker, Richard  
Laud, William  
Andrewes, Lancelot  
Hall, Joseph  
Ken, Thomas  
Leighton, Robert  
Taylor, Jeremy  
Sanderson, R.  
Whitgift, J.  
Tillotson, John  
Wake, William  
Atterbury, Francis  
Warburton, William  
Simeon, Charles  
Romaine, W.  
Pusey, Edward Bouverie  
Keble, John  
Rose, Hugh James  
Forbes, Alexander P.  
Liddon, Henry Parry  
Maurice, Frederick Denison  
Arnold, Thomas  
Robertson, Frederick W.  
Milman, Henry Hart  
Jowett, Benjamin  
Stanley, Arthur Penrhyn  
Wilberforce, Samuel  
Trench, Richard Chenevix  
Vaughan, Charles J.  
Wordsworth, Charles  
Wordsworth, Christopher  
Benson, Edward White  
Lightfoot, Joseph Barber  
Westcott, Brooke Foss  
Thorold, Anthony Wilson  
Stubbs, William  
Bright, William

Tait, Archibald Campbell  
 Temple, Frederick

Of the Church in America the leading representatives have been :

Seabury, Samuel  
 White, William  
 Hobart, John Henry  
 Provoost, Samuel  
 Hopkins, John Henry  
 Muhlenberg, William Augustus  
 Tyng, Stephen H.  
 Whittingham, William Rollinson  
 Williams, John  
 Whipple, Henry B.  
 Potter, Horatio  
 Potter, Alonzo  
 Potter, Henry Codman  
 Brooks, Phillips  
 Newton, Richard Heber  
 Dix, Morgan

(b) PRESBYTERIAN :

Presbyterianism  
 Elder  
 Moderator  
 Synod  
 Westminster Assembly  
 Perth, Five Articles of  
 Cameronians  
 Covenants, The  
 Infralapsarian  
 Alexander, Archibald  
 Alexander, J. A.  
 Babcock, M. D.  
 Baird, C. W.  
 Briggs, C. A.  
 Burrell, D. J.  
 Calamy, Edmund  
 Cameron, J.  
 Chalmers, Thomas  
 Cuyler, T. L.  
 Geddes, J.  
 Green, W. H.

Hall, John  
 Hodge, C.  
 Knox, John  
 Melville, Andrew  
 Parkhurst, C. H.  
 Patton, F. L.  
 Paxton, J. R.  
 Prentiss, G. L.  
 Prime, S. I.  
 Robinson, C. S.  
 Shields, C. W.  
 Talmage, T. DeWitt  
 Tennent, Gilbert  
 Watson, John  
 Witherspoon, J.

(c) METHODIST :

Methodism  
 Itinerancy  
 Experience Meeting  
 Camp-Meeting  
 Epworth League  
 Wesley, John  
 Wesley, Charles  
 Whitefield, George  
 Coke, Thomas  
 Huntingdon, Selima Hastings  
 Asbury, Francis  
 Clarke, Adam  
 Emory, John  
 Fowler, C. H.  
 Haven, E. O.  
 Haven, Gilbert  
 Hurlbut, J. L.  
 Hurst, John F.  
 Moore, D. H.  
 Moore, Henry  
 Newman, J. P.  
 Ouseley, G.  
 Punshon, W. M.  
 Sankey, Ira D.  
 Strong, James  
 Taylor, W.  
 Tefft, B. F.

Townley, James  
Townsend, L. T.  
Vincent, J. H.  
Walden, J. M.  
Warren, H. W.  
Watson, R.  
Wise, Daniel

(d) CONGREGATIONALIST:

Congregationalism  
Puritans  
Separatists  
Browne, Robert  
Robinson, John  
Cotton, John  
Mather, Richard  
Hooker, Thomas  
Edwards, Jonathan  
Hopkins, Samuel  
Bellamy, Joseph  
Dwight, Timothy  
Abbott, Lyman  
Bartlett, S. C.  
Beecher, Henry Ward  
Beecher, Lyman  
Bissel, E. C.  
Bushnell, H.  
Dexter, H. M.  
Finney, C. G.  
Gladden, W.  
Park, E. A.  
Parker, Joseph  
Phelps, Austin  
Storrs, R. S.  
Taylor, N. W.

(e) BAPTIST:

Baptists  
Baptism  
Baptism, Infant  
Anabaptists  
Münzer, T.  
John of Leyden  
Mennonites  
River Brethren

Burrage, H. S.  
Conant, T. J.  
Hall, R.  
Lorimer, G. C.  
Peters, M. C.  
Ripley, H. J.  
Robinson, E. G.  
Spurgeon, C. H.  
Vedder, H. C.  
Wayland, F.

(f) LUTHERAN:

Lutheranism  
Reformation, The Protestant  
Luther  
Melanchthon  
Augsburg Confession  
Greenwald, Emanuel  
Muhlenberg, H. M.  
Muhlenberg, J. P. G.  
Seiss, J. A.  
Stuckenberg, J. H. W.

(g) DUTCH REFORMED:

Reformed Church in America  
Belgic Confession  
Heidelberg Catechism (under  
Catechism)  
Dort, Synod of  
Classis  
Ferris, I.  
Riddle, M. B.

(h) QUAKER OR FRIENDS:

Friends  
Fox, George  
Penn, William  
Hicks, Elias  
Gurney, J. J.  
Wilbur, John

(i) UNITARIAN:

Unitarianism  
Arius  
Socinus  
Servetus, Michael

Biddle, John  
 Priestley, Joseph  
 Allen, J. H.  
 Chadwick, J. W.  
 Channing, W. E.  
 Collyer, Robert  
 Freeman, James  
 Frothingham, O. B.  
 Hill, Thomas  
 Parker, Theodore  
 Savage, M. J.  
 Ware, Henry

(j) UNIVERSALIST:  
 Universalism  
 Rely, James  
 Murray, John  
 Ballou, Hosea  
 Hanaford, Phebe A.

(k) MORMON:  
 Mormons  
 Smith, Joseph  
 Pratt, Orson  
 Rigdon, S  
 Taylor, John  
 Woodruff, W.  
 Young, Brigham

(l) OTHER DENOMINATIONS:  
 Adventists  
 Miller, William  
 Christian Catholic Church  
 Christians  
 Christian Science  
 Disciples of Christ  
 Eddy, Mary Baker Glover  
 Evangelical Alliance  
 German Baptist Brethren  
 German Evangelical Protestant  
 Church  
 German Evangelical Synod of  
 North America  
 Institutional Church  
 Moravians  
 Brethren, Bohemian

Huss, John  
 Comenius, J. A.  
 Zinzendorf, Nikolaus  
 Reformed Church in the Unit-  
 ed States.  
 United Brethren in Christ  
 Otterbein, P. W.  
 Evangelical Association

### III. MOHAMMEDANISM.

The history of Islam is closely connected with the history of the nations which adopted it as their creed. Though the spread of Mohammedanism has at all times been to some extent due to missionary zeal, its extension has largely been coincident with conquests. The political aspect of Moslem history may be best studied under the names of Mohammedan nations, dynasties, and rulers, such as ABBASIDES, OMMIADS, SELJUKS, TURKEY, ARABIA, etc. Here are only given the leading titles dealing with the religious development and present character of the faith.

For the Rise of Islam, see:

Mohammed  
 Mohammedanism  
 Mohammedan Sects  
 Islam  
 Mecca  
 Medina  
 Hejira  
 Ayes Shah

For the successors of Mohammed and early conquerors who spread the gospel of Islam in Asia, Africa, and Europe, see:

Caliph  
 Abu-Bekr  
 Omar

Othman  
Ali  
Omniads  
Khalid  
Musa ibn Nusair  
Amr ibn al-Asi  
Tarik  
Idrisites  
Aghlabids  
Fatimites  
Almoravides  
Almohades

For the tenets and practices of the faith, in addition to the titles already quoted, see:

Koran  
Sunna  
Hadith  
Kaaba  
Hajj  
Hajji  
Fast  
Ramadan  
Beiram  
Muharram  
Kiblah  
Houri  
Jinn  
Iblis

Imam  
Mufti  
Muezzin  
Ulema  
Madrasah  
Marabouts  
Mosque

For Sects and Parties, see:

Sunnites  
Shiites  
Hasan and Husain  
Mahdi  
Nosairians  
Assassins  
Druses  
Hakim ibn Allah  
Mutazilites  
Sincere Brethren  
Wahabis  
Dervish  
Babism  
Sufism  
Senussi

For Mohammedan Theologians:

Abu Hanifah  
Ibn Hanbal  
Ibn Tumart  
Ghazali



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# Chapter 7. Education

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**T**HE study of the science of education is peculiarly related to the study of the growth and development of the intellectual, moral, and spiritual life of the human race. Every department of knowledge is necessarily in some way connected with the science of education. Most of the great thinkers of all ages have contributed to the literature of the science, and consequently many names must be included in our list of educators which appear, as well, in some other field. As part of some one philosophical system or another, education goes back to early times, but its history as an independent science, separated from philosophy or theology, is quite recent. Its problems, too, have grown immeasurably more complex with the progress of democratic ideals and the widening of its sphere of interest. More even than national defense, the fostering of public education has come to be the great function of the modern State; and, though differences of opinion prevail as to how far this obligation extends in practice, in all progressive countries there is no class of men whom the government, in one way or another, does not attempt to supply with the means of education.

There are three sides from which students may approach the study of the science: the historical, the psychological, and the pedagogical.

The History of education is outlined in the Article EDUCATION, which traces its development from the dawn of civilization to the present day. A more detailed study of the subject may be systematically pursued in the following lists of articles. The subject is usually divided into four periods: Pre-Christian (including the Oriental and the Classical types), Early Christian, Mediæval, and Modern.

## I. THE PRE-CHRISTIAN PERIOD.

(a) The several types of Oriental education are discussed in the following articles:

Confucius  
Buddhism  
Caste  
Jews  
Talmud  
Rabbi  
Mohammedanism  
Ulema  
Mufti  
Madrasah

(b) The aims of Greek and Roman educators, and the methods by which

they strove to attain their ideals, are discussed under the following heads:

Sophists  
Socrates  
Plato  
Aristotle  
Xenophon  
Cyropædia  
Sparta  
Games  
Plutarch  
Quintilian

## II. THE EARLY CHRISTIAN PERIOD.

The part played by the early Christian Fathers in the furtherance of education and the establishment of schools will be found under:

Catechumens  
Catechetical Schools  
Chrysostom  
Basil the Great  
Clement of Alexandria  
Origen  
Theodore of Mopsuestia

For the struggle between the pagan and early Christian educators, see:

Tertullian  
Augustine

These bring the student up to the Mediæval period.

### III. THE MEDIÆVAL PERIOD.

In the series of articles dealing with this period, the student will find an account of the efforts made by the Church to promulgate education throughout Christendom, and will be led up to the modern movement, which properly co-extends with the movement that led up to and through the Reformation. See:

Monasticism  
Benedictines  
Arts, Liberal  
Quadrivium  
Trivium  
Scholasticism  
Charles the Great  
Alcuin  
Alfred the Great  
Abélard  
Chivalry  
University

### IV. THE MODERN PERIOD.

Educational progress was hastened and turned into varying channels by the revival of the old learning. The Reformation initiated the separation of education from theology, and, by breaking up the unit of European culture, gave rise to national systems of

education and the use of the national vernaculars as the medium of instruction. For the early educational reformers, see:

Renaissance  
Humanism  
Dante  
Petrarch  
Boccaccio  
Poggio Bracciolini  
Pico della Mirandola  
Poliziano  
Reuchlin  
Erasmus  
Budæus  
Scaliger, J. J.  
Scaliger, J. C.  
Casaubon, I.  
Hardouin, J.  
Reformation, The Protestant  
Luther  
Melanchthon  
Sturm, Johannes  
Ascham, Roger  
Rabelais  
Montaigne  
Bacon, Francis  
Induction  
Ratichius  
Comenius  
Orbis Pictus

The efforts of the Catholic Church to counteract the effects of the Reformation may be studied in the following articles:

Ignatius of Loyola  
Jesuits  
Ratio Studiorum  
Jansenism  
Port-Royal-des-Champs

For the activity of the Church in supplying education to the very young, see:

La Salle, Jean Baptiste de  
Brothers of the Christian Schools

For writers who contributed to the advancement of the science of education, see:

Milton, John  
Locke, John  
Fénelon, François

The realistic movement in education begins with FRANCKE, and the *Realschule* had its inception in his efforts. The movement culminates in the thorough sweeping away of old methods and ideas in education, foreshadowed in Rousseau's protest in his *Emile*. See:

Francke, A. H.  
Rousseau  
Emile  
Basedow  
Pestalozzi  
Girard, J. B.  
Jacotot  
Fröbel  
Kindergarten  
Herbart  
Mann, Horace  
Spencer, Herbert  
Arnold, Thomas  
Bell, Andrew  
Lancaster, Joseph

The systems of education prevalent in Europe and America are treated with great minuteness in the article on NATIONAL EDUCATION, SYSTEMS OF. The subject is further amplified in the sections on Education of the articles on the various countries of the world, wherein the statistical side is emphasized. The various phases of State activity receive full attention in the following articles:

Schools

Public Schools  
Evening Schools  
Secondary Schools  
High Schools  
Grammar Schools  
Gymnasias  
Realschule  
Women, Education of  
Negro Education  
Industrial Schools  
Vacation School  
Education, Colonial

#### V. PEDAGOGY.

Pedagogy is that branch of the science of education which deals with the methods and means of carrying out educational ideas. The old and the new educational methods receive comprehensive treatment in the article PEDAGOGY, which is amply supplemented by the following articles:

Nature-Study  
Child Psychology  
Object Teaching  
Curriculum  
Kindergarten  
Physical Training  
Manual Training  
Normal School  
Education, Commercial  
Technical Education  
Professional Education  
Theological Education  
Medical Education  
Legal Education  
Agricultural Education  
Seminar  
Privat-Dozent  
Reading  
Spelling

#### VI. EDUCATIONAL INSTITUTIONS.

The growth of colleges and universities in Europe and America is treated from the general standpoint in the

article on UNIVERSITY. This is supplemented by separate accounts of all of the important colleges and universities in the world. The list of American colleges and universities is especially complete; to such an extent, indeed, that mention may be made of only a few of the most prominent.

See:

- University
- College
- Colleges, American
- Carnegie Foundation
- General Education Board
- Curriculum
- Elective Courses
- Degree
- Diploma
- Examination
- Fellowship
- University Extension
- Harvard University
- Yale University
- Princeton University
- Columbia University
- Pennsylvania, University of
- Brown University
- Cornell University
- Johns Hopkins University
- Clark University
- Chicago University
- Leland Stanford Junior University
- Catholic University of America
- Amherst College
- Bowdoin College
- Dartmouth College
- William and Mary College
- Williams College
- Girard College
- Carnegie Institution

The State universities have all been written up in detail.

For a group of women's colleges in the United States, see:

- Barnard College
- Bryn Mawr College
- Goucher College
- Mount Holyoke College
- Radcliffe College
- Smith College
- Vassar College
- Wellesley College

In this connection see also:

- Collegiate Education of Women
- Coeducation

For English universities and schools, see:

- Oxford University
- Rhodes Scholarships
- Cambridge, University of
- London University
- Liverpool, University of
- Manchester, University of
- National University of Ireland
- Dublin University
- Girton College
- Newnham College
- Eton College
- Rugby School
- Harrow School
- Shrewsbury School
- Winchester College

For the greatest of European universities, either in present importance or historically, see:

- Paris, University of
- Berlin, University of
- Vienna, University of
- Madrid, University of
- Munich, University of
- Moscow, University of
- Leipzig, University of
- Edinburgh, University of
- Heidelberg, University of
- Bologna, University of
- Padua, University of

Salerno, School of  
Coimbra, University of  
Salamanca, University of  
Montpellier, University of  
Prague, University of

A partial list of prominent educators of the modern times includes:

Adams, C. K.  
Ames, J. B.  
Andrews, E. B.  
Angell, J. B.  
Arnold, T.  
Barnard, F. A. P.  
Barnard, Henry  
Bascom, J.  
Brown, E. E.  
Butler, N. M.  
Clayton, P. P.  
De Garmo, C.  
Dewey, John  
Drisler, Henry  
Eliot, C. W.  
Gildersleeve, B. L.  
Gilman, D. C.  
Hadley, A. T.  
Hadley, James  
Hall, G. S.  
Hanus, P. H.  
Harkness, A.  
Harper, W. R.  
Harris, W. T.  
Hill, D. J.  
James, E. J.  
James, W.

Jebb, Sir R. C.  
Jordan, D. S.  
Jowett, B.  
Low, Seth  
Lyon, Mary  
McCosh, J.  
McMurry, F. M.  
Monroe, Paul  
Pattison, Mark  
Patton, F. L.  
Quick, R. H.  
Sadler, M. E.  
Schurman, J. G.  
Sidgwick, Mrs.  
Washington, Booker T.  
Wendell, Barrett  
West, Wm. A.  
Wheeler, B. I.  
White, A. D.  
Whitney, W. D.  
Wirt, Wm. A.  
Young, Ella Flagg

For classes of institutions that have become centres for the spread of popular education, see:

(a) Libraries:

New York Public Library  
Book  
Alexandrian Library  
Bodleian Library  
British Museum  
Bibliothèque Nationale  
Library of Congress

(b) Museum

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## 8. Philosophy and Psychology

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**T**HOUGH great diversity exists as to the meaning and scope of the term Philosophy, two definitions may be given as representative. The more modern view regards philosophy as the sum of all scientific knowledge, or the systematization of results obtained in the individual sciences; the historical and more prevalent view looks upon philosophy as the search for the ultimate nature and meaning of the universe, and especially of human life. Embracing at one time the totality of scientific knowledge, the field of philosophy has steadily grown narrower with the erection of independent sciences, until at the present day it includes the studies of metaphysics, logic, ethics, and æsthetics. Psychology is the latest branch of investigation to achieve its emancipation from philosophy, whose methods, historically, have been quite different from those that prevail in the scientific world to-day.

I. 1. The problems of philosophy are best studied, perhaps, historically. A brief summary, however, in necessarily technical language, will serve to present the main outlines of the subject in the form in which they have appeared to thinkers of different ages. Generally, then, the problems of philosophy are divided into three classes: those which deal with the ultimate nature of the universe, grouped under the heading **METAPHYSICS**; those which deal with the forms of human knowledge and its relation to reality, known as epistemology, or the theory of knowledge; and those dealing with human conduct, included in the science of ethics. See:

Philosophy  
Metaphysics  
Knowledge, Theory of  
Ethics

2. The inquiry into the nature of reality takes on two forms: that concerned with the ultimate nature of things, and that dealing with the connection between things, or the architectural plan of the universe.

(a) For the First, see:

Ontology  
Dualism  
Monism  
Materialism  
Mechanism  
Realism  
Idealism

(b) For the Second, see:

Atomism  
Theism  
Transcendentalism  
Pantheism  
Body and Mind  
Parallelism  
Substance  
Form  
Causality  
Time  
Space  
Teleology  
Infinite  
Absolute

3. In connection with our knowledge of the universe, two questions arise: (a) Taking the conglomeration of ideas we call knowledge, is there an outside Reality corresponding to them,

or are they Reality itself; and (b) are these ideas in origin the result of experience, or are they independent of experience? See:

- (a) Realism
  - Idealism
  - Skepticism
- (b) Empiricism
  - Rationalism
  - A priori
  - Dialectic
  - Category
  - Induction
  - Deduction

II. 1. The history of European philosophy begins with the Greeks, in whom, however, strong Oriental influences are traceable. Their earliest philosophy was a nature philosophy, and its two great problems were those of Being and Becoming. See:

- Greek Philosophy
- Thales
- Anaximander
- Anaximenes
- Eleatic School
- Xenophanes
- Parmenides
- Zeno (the Eleatic)
- Gorgias
- Heraclitus
- Pythagoras
- Pythagoreanism
- Neo-Pythagoreanism
- Archytas
- Metempsychosis
- Empedocles
- Anaxagoras
- Atomism
- Leucippus
- Democritus

2. In the second period, the main interest of philosophy becomes anthro-

pological or ethical, the tendency being most fully apparent in the figure of the great teacher Socrates, from whom descend the great schools of the Hellenistic world, Platonists, Stoics, Hedonists, Cynics. Plato and Aristotle by their genius moulded almost the channels in which philosophic thought was to flow in the future. Greek philosophy, toward its end, exerted a powerful influence on Christianity. See:

- Sophists
- Protagoras
- Socrates
- Hedonism
- Cyrenaic School
- Aristippus
- Hegesias
- Epicurus
- Epicureanism
- Lucretius
- Stoics
- Zeno (the Stoic)
- Cleanthes
- Chrysippus
- Seneca
- Epictetus
- Aurelius, Marcus
- Cynics
- Antisthenes
- Diogenes
- Euclid (of Megara)
- Plato
- Academy
- Arcesilaus
- New Academy
- Carneades
- Aristotle
- Peripatetic Philosophy
- Pyrrho
- Ænesidemus
- Sextus Empiricus
- Skepticism

Neo-Platonism  
 Philo Judæus  
 Ammonius  
 Plotinus  
 Porphyrius  
 Iamblichus  
 Proclus  
 Boëthius  
 Anima Mundi  
 Logos  
 Eclecticism  
 Cicero

3. From the Platonic philosophy, as contained in the writings of the Christian Fathers, mediæval philosophy developed into the system known as Scholasticism, which in its fullest development, however, became Aristotelian, through the influence of the Arabian philosophers. Philosophy became the handmaiden of theology, and it supported the mysteries of the Christian faith by means of a subtle dialectic. The downfall of scholasticism began with the fourteenth century, and was hastened by the Revival of Learning. See:

Scholasticism  
 Augustine (of Hippo)  
 Erigena  
 Rabanus Maurus  
 Peter Lombard  
 Realism  
 Anselm of Canterbury  
 Guillaume de Champeaux  
 Nominalism  
 Roscelinus  
 Durandus  
 Occam, William of  
 Buridan, Jean  
 Ailly, Pierre d'  
 Concept  
 Abélard  
 Averroës

Avicenna  
 Albert of Bollstädt  
 Alexander of Hales  
 Vincent of Beauvais  
 Aquinas, Thomas  
 Duns Scotus  
 Suárez, Francisco  
 Mysticism  
 Hugo of St. Victor  
 Bernard of Clairvaux  
 Bonaventura, St.  
 Eckhardt  
 Tauler  
 Kempis  
 Böhme  
 Quietism  
 Molinos  
 Bacon, Roger  
 Lully, Raymond  
 Cusa, Nikolas  
 Renaissance

The Revival of Learning brought about a temporary revival of the classic philosophies, but these served only to bridge over the chasm between the ancient thought and the modern philosophy, whose beginning dates from the establishment of Empiricism by Bacon and Rationalism by Descartes. The subjects of Substance and Causality now assume leading importance. Cartesian rationalism ends in dogmatism on the Continent; empiricism ends in skepticism in England. See:

Bruno, Giordano  
 Campanella, T.  
 Gassendi  
 Rationalism  
 Descartes  
 Malebranche  
 Occasionalism  
 Spinoza  
 Pantheism  
 Leibnitz



Preëstablished Harmony

Monad

Wolff, Christian

Baumgarten, A. G.

Eberhard, J. A.

Mendelssohn, Moses

Vico, G. B.

Empiricism

Hobbes, Thomas

Locke, John

Sensationalism

Clarke, Samuel

Butler, Joseph

Paley, William

Berkeley, George

Cambridge Platonists

Cudworth, Ralph

More, Henry

Hume, David

Charron, Pierre

Toland, John

Hartley, David

Priestley, Joseph

Condillac

La Mettrie

Diderot

D'Alembert

Helvétius

Holbach

Cabanis, J. P. G.

Genovesi, A.

Enlightenment, Philosophy of the  
Common Sense, Philosophy of

Reid, Thomas

Beattie, James

Stewart, Dugald

Hamilton, William

The critical philosophy of Kant sought to mediate between Rationalism and Empiricism by assigning to either its proper function in the mental life; and, though Kantianism was followed by the rise of great rationalistic systems in Germany, in which the

balance was overthrown anew, the teachings of the Königsberg philosopher have shown the greater vitality as being in consonance with the spirit of the growing sciences. Reaction against unrestrained idealism led to Positivism, in which philosophy becomes a correlation of sciences. Materialism, after a brief popularity, seems to have passed away forever. See:

Kant

Herder

Jacobi, F. H.

Hamann, J. G.

Krause, K. C. F.

Reinhold, C. E.

Rosenkranz, K.

Erdmann, J. E.

Trendelenburg

Zeller, E.

Ulrich, H.

Fischer, Kuno

For the important systems that arose after Kant, see:

Fichte, J. G.

Fichte, I. H.

Schelling

Hegel

Feuerbach, L. A.

Green, T. H.

And for a philosophy of will that has exercised a profound influence on modern thought:

Schopenhauer

Pessimism

Hartmann, Karl Robert

Materialism was fostered by the doctrine of evolution and the Darwinian discoveries. See:

Moleschott, J.

Büchner, F. L.

Vogt, Karl

Haeckel, E.

For the neo-Kantianism of the latest scientific thought, see:

Lange, F. A.  
Cohen, Herman  
Du Bois-Reymond, E. H.  
Helmholtz  
Virchow  
Wundt  
Renan  
Taine

For systematic attempts at reconciling philosophy and religion, see:

Schleiermacher  
Ritter, Heinrich  
Rosmini-Serbati  
James, Wm.

For philosophies that have been made the basis of important pedagogical psychologies, see:

Herbart  
Flügel, O.  
Beneke  
Lotze  
Fechner  
Paulsen, Friedrich

Spiritualism had influential exponents in France in the beginning of the nineteenth century. See:

Royer-Collard  
Cousin, Victor  
Maine de Brian  
Jouffroy, T. S.  
Psychical Research  
Myers, F. W. H.

Spiritualism found its reaction in the epoch-making work of Comte. See:

Positivism  
Agnosticism  
Comte  
Littré  
Mill, J. S.

Spencer, Herbert  
Lewes, G. H.  
Harrison, Frederic  
Riehl, A.

For philosophic thought in America, see:

Edwards, Jonathan  
Transcendentalism  
Emerson, R. W.  
Ripley, G.  
Alcott, A. B.  
Channing, W. E.  
Thoreau, H.  
McCosh, J.  
Harris, W. T.  
Royce, J.  
James, Wm.  
Ladd, G. T.  
Dewey, J.

Every well-rounded philosophical system has its logic, ethics, and æsthetics, and strictly speaking these cannot be divorced from the discussions of purely metaphysical problems. Nevertheless, as important subdivisions of philosophy, they have received an amount of attention that give them independent consideration.

A. The problems of human conduct are discussed minutely in the general article on ETHICS, and further differentiated in subsidiary articles. See:

Ethics  
Will  
Free Will  
Casuistry  
Chance  
Fatalism  
Determinism  
Indifferentism  
Egoism  
Altruism  
Energism

Eudæmonism  
 Intuitionism  
 Categorical Imperative  
 Utilitarianism  
 Hutcheson  
 Bentham, J.  
 Austin, J.  
 Mill, J. S.  
 Nietzsche, F.  
 Stephen, Leslie  
 Sidgwick, H.  
 Martineau, J.  
 Green, T. H.  
 Caird, E.  
 Alexander, Samuel  
 Fouillée  
 Simmel, G.

B. The formal rules of thought as outlined by Aristotle have received modifications at the hands of both rationalists and empiricists, the influence of the latter being, however, the more pronounced on the development of the science. See:

Logic  
 Knowledge, Theory of  
 Induction  
 Deduction  
 Argument  
 Syllogism  
 Analysis  
 Synthesis  
 Abstraction  
 Hypothesis  
 Judgment  
 Definition  
 Division  
 Percept  
 Concept  
 Connotation  
 Denotation  
 Obversion  
 Opposition  
 Comparison

Analogy  
 Identity, Law of  
 Fallacy  
 Dilemma  
 Mill J. S.  
 Jevons  
 Whately, R.

C. The separate science of æsthetics dates only from the eighteenth century. Its latest development has been along experimental and anthropological lines. See:

Æsthetics  
 Æsthetics, Experimental  
 Baumgarten, A. G.  
 Lessing, G. E.  
 Shaftesbury, third Earl of  
 Hogarth  
 Bain  
 Bosanquet  
 Santayana, George

D. The psychology of the present differs from earlier investigations of the human mind in its application of a more rigorous scientific method. It assumes no metaphysical substratum for mental life, but is content to take experience as its ultimate fact and to study its forms and manifestations. Though the science is to be dated only from the latter half of the nineteenth century, it has already been found necessary to divide the field of investigation for the purpose of the more effective study of the mind of the adult, the child, and the abnormal individual, and the collective mind of the crowd. The method of psychology is ultimately introspective, but it is introspection carefully pursued and corrected by the standard of the scientific average. For classification and methods, see:

Psychology

Individual Psychology  
 Genetic Psychology  
 Child Psychology  
 Social Psychology  
 Folk-Psychology  
 Insanity  
 Psychology, Experimental  
 Psychological Apparatus  
 Psychophysics  
 Introspection  
 Phrenology

Intensity of Sensation  
 Extension  
 Duration  
 Quality  
 Discrimination, Sensible  
 Contrast  
 Reaction  
 Weber's Law  
 Limen  
 Relativity, Law of

(c) For a Classification of Sensations,  
 see:

With mental experience as basis for analysis, psychology finds that the analytical element of mental life is sensation, and sensations depend on bodily processes set in motion by external stimuli. Sensations are classified according to the organs whose stimulation they accompany. For mind in general, and its relation to body, see:

(a) Mind  
     Elements, Conscious  
     Mental Process  
     Self  
     Self-Consciousness  
     Unity of Consciousness  
     Double Consciousness  
     Sleep  
     Dreaming  
     Hypnotism  
     Autosuggestion  
     Somnambulism  
     Consciousness  
     Noetic Consciousness  
     Meaning  
     Body and Mind  
     Subconsciousness  
     Subliminal Consciousness  
     Cerebration, Unconscious

(b) For Sensation, see:  
     Sensation  
     Sensorium

Vision  
 Visual Sensation  
 Blind Spot  
 After-images  
 Illusion  
 Mirage  
 Hallucination  
 Clairvoyance  
 Apparition  
 Color  
 Saturation  
 Color-Blindness  
 Audition  
 Clang-Tint  
 Colored Hearing  
 Fusion  
 Smell  
 Taste  
 Touch  
 Cutaneous Sensations  
 Static Sense  
 Muscle Sense  
 Muscle-Reading  
 Pain  
 Fatigue  
 Common Sensation  
 Organic Sensations

From simple sensations the higher intellectual processes (perception, idea, association of ideas, etc.) are synthesized. A corresponding process has

been brought forward as the analytical element of our emotional life, and has been denominated Affection. From a combination of sensational and affective elements arise the various processes classified under the general designation, Will. It is thus that the new psychology improves upon the threefold division of Intellect, Reason, and Will in the older psychology. See:

Affection  
Conation  
Attention  
Effort  
Interest  
Tendency  
Disposition  
Faculty  
Mental Constitution

(a) For the Complex Sensational Processes:

Perception  
Idea  
Movement, Perception of  
Locality, Perception of  
Distance, Perception of  
Figure  
Rhythm  
Melody  
Association of Ideas  
Retention  
Reproduction of Ideas  
Memory  
Apperception  
Recognition  
Familiarity  
Apprehension  
Imagination  
Judgment  
Ratiocination  
Understanding  
Abstraction

Intellect

(b) For the Affective or Emotional Processes:

Feeling  
Emotion  
Mood  
Temperament  
Mental Constitution  
Sentiment  
Sympathy  
Antipathy  
Fear  
Anger  
Belief  
Expectation  
Expression  
Laughter  
Language  
Gesture

(c) For the Will Processes:

Will  
Action  
Instinct  
Impulse  
Desire  
Habit  
Practice

In the field of experimental investigation, Germany holds the first rank. Excellent work has been done in France, especially in the field of abnormal psychology, and in England and America, where German thought has blended with the native empiricism. See:

(a) Weber, E. H.  
Fechner, G. T.  
Helmholtz, H.  
Hering, E.  
Flehsig, P. E.  
Stumpf, K.  
Müller, G. E.

Wundt, W.  
(*b*) Bain, Alexander  
Romanes, G. J.  
Galton, F.  
Stout, G. F.  
Sully, James  
(*c*) Binet, A.  
Charcot, J. M.

Ribot, T. A.  
(*d*) James, William  
Ladd, G. T.  
Münsterberg, H.  
Dewey, John  
Titchener, E. B.  
Baldwin, J. M.  
Hall, G. S.

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# Chapter 9. Language and Literature

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**T**HE tracing of the mutual relations of the various languages of the world, and the study of their similarities and differences, is the task of the science of comparative philology. The phonetic, or mechanical side, the inflectional, or constructive, and the syntactic, or psychological aspect, are the three factors which combine to form human speech. See:

## A. Language

### 1. PHILOLOGY.

Philology  
Grammar  
Dialect  
Phonetics  
Accent  
Phonetic Law  
Grimm's Law  
Verner's Law  
Etymology  
Grassman's Law  
Inflection  
Declension  
Comparison  
Nouns  
Name  
Gender  
Adjective  
Pronoun  
Article  
Adverb  
Preposition  
Conjunction  
Interjection  
Verb  
Participle  
Conjugation  
Reduplication  
Ablaut  
Umlaut  
Syntax, Figures of  
Sentence  
Semasiology

Slang  
Metaphor  
Orthography, Figures of  
Prosody  
Rhyme  
Assonance  
Alphabet  
Inscriptions  
Paleography  
Runes  
Spelling  
Rhetoric  
Pronunciation  
Phonetics

2. For a classification of languages in related groups, see:

(a) *For the Monosyllabic Type:*  
Chinese Language

(b) *For the Agglutinative Type:*  
African Languages  
Egyptian (under Egypt)  
Coptic (under Copts)  
Ural-Altaic  
Finnish Language  
Turkish Language  
Japanese Language  
Dravidians  
Tamils  
Telugus  
Philippine Languages

(c) *For the Polysynthetic Type (Incorporating):*

American Indian (under Indians, American):

(d) *For the Inflectional Type:*

Semitic Languages

Cuneiform Inscriptions

Aramaic

Syriac Language

Samaritan Language

Moabitish Language (under Moabite Stone)

Arabic Language

Inflectional also are:

(i) Indo-Germanic Languages

(ii) The Languages of India:

Sanskrit

Pali

Prākṛit

Assamese (under Assam)

Bengali

Ceylonese (under Ceylon)

Gujarātī

Hindustani

Kashmiri

Maldivē

Marathi

Panjabi

Sindhi

Uriya

(iii) The Iranian Languages:

Iranian Languages

Old Persian

Avesta

Pahlavi

Persian

Afghan

Baluchi

Kurdish

Ossetic

(iv) Armenian

(v) Albanian

(vi) Mediterranean Languages:

Greek

Italic Languages

Latin

Italian

Spanish

Norman French

French

Provençal

Rumanian

Portuguese

(vii) The Teutonic Languages:

Teutonic Languages

Gothic

Icelandic

Norwegian

Swedish

Dutch

German

Plattdeutsch

Frisian

Flemish

Anglo-Saxon

English

Americanisms

(viii) The Celtic Languages:

Celtic Languages

Cornish

(ix) The Balto-Slavic Languages:

Old Prussian

Lettic

Lithuanian

(x) The Slavic Languages:

Slavic Languages

Old Church Slavic

Polish

Russian

Czech or Bohemian Language

See also:

International Languages

Esperanto

Volapük



3. For the great names in the field of comparative philology, see:

Ascoli, G. I.

Bopp, F.

Brugmann, F. K.

Breal, M.

Bugge, S.

Burnouf, E.

Grimm, J. L. K.

Grundtvig, S. H.

Kölbing, E.

March, F. A.

Menéndez Pidal, R.

Meillet, A.

Paris, G.

Pott, A. F.

Rask, R. K.

Rousselot, Abbé

Schlegel, F.

Schleicher, A.

Schmidt, J.

Sievers, E.

Skeat, W. W.

Stokes, W.

Sweet, H.

Thomas, André Antoine

Taylor, W.

Verner, K. A.

Vigfusson, G.

Webster, Noah

Whitney, W. D.

Zeuss, S. C.

## B. Literature

Literature, which is the expression, more or less permanent, in language, of human thought and emotions, would include in its widest sense every written record of man's activity, the university man's dissertation on the Coleoptera no less than Shelley's "Ode to the Skylark." Such a wide connotation of the term would render any classification within reasonable space limits impossible, and in the present chapter the matter has been restricted to the treatment of what we ordinarily call *Belles-lettres*. The great works in history and the various fields of science and philosophy will be accounted for in the chapters with the subject matter of which they are more intimately connected. A more considerable difficulty than that of settling limits to the scope of the term literature is that of determining a reasonably fixed standard of classification, owing to the twofold aspect under which

every literary monument presents itself—as form or matter. Taking, for instance, any specific department of literature, such as satire, we find that our satirist may be, as regards form, a lyricist, novelist, essayist, or dramatic writer. The man we call poet may, in the same manner, have turned the poetic form to the uses of comedy or of the lyric spirit. Again, commonly, a literary artist will have attained eminence in different categories of literature, as the drama, say, criticism, and poetry, and the necessity arises of partially and often arbitrarily characterizing such a man. A certain measure of violence is, therefore, unavoidable when the attempt is made to cast any great literary figure into a rigidly labeled department; but there is sufficient justification for the scheme in the fact that, as a rule, the great literary figure does stand out pre-eminently in one department of the art,

and, remembering that the line of division is by no means rigid, we may classify him accordingly.

The historical study of literature may be pursued in two ways. There is the vertical order, as it may be called, in which we take up the national literatures one by one, a method of study in which the various literary genres are considered at the same time, and wherein the formal side is naturally subordinated to the investigation of the development of national character as revealed in the national literature. There is also what may be called the horizontal order, where our attention is confined to one kind of literature at a time, whose development is traced from the beginning to the present day, across national boundaries, the process essentially being one of thematic unity, as compared with the preceding method of national unity. Either method has its advantages, and the material in the *New International Encyclopædia* has been so treated as to lend itself to either form of study; but, whereas the student or reader who would devote himself to the study of national literatures may be left to his own resources in view of the obvious classification followed, the need for guidance is apparent in the second. Emphasis, therefore, in the present chapter is laid on the formal development of the literary form, the underlying principle being the belief that the larger number of students are apt to turn to a specialized subject, like the history of the novel or the epic, rather than to the expanded story of an entire national literature.

## I. THE NATIONAL LITERATURES.

American Literature

Arabic Language and Literature  
 Armenian Language and Literature  
 Australian Literature  
 Bengali Language and Literature  
 Breton Literature  
 Canadian Literature  
 Catalan Language and Literature  
 Chinese Language and Literature  
 Cuban Literature  
 Czech Literature  
 Danish Language and Literature  
 Dutch Literature  
 Egyptian Language and Literature  
 (under Egypt)  
 English Literature  
 Finnish Language and Literature  
 Flemish Language and Literature  
 French Literature  
 Frisian Language and Literature  
 German Literature  
 Greek Literature  
 Hindustani Language and Literature  
 Hungarian Literature  
 Icelandic Literature  
 Iranian Languages and Literatures  
 Irish Literature  
 Italian Literature  
 Japanese Literature  
 Jewish Language and Literature  
 (under Jews)  
 Latin Literature  
 Lettic Language and Literature  
 Lithuanian Language and Literature  
 Mexican Literature  
 Norwegian Literature  
 Old Church Slavic Language and Literature  
 Pahlavi Language and Literature  
 Persian Literature  
 Polish Literature  
 Portuguese Literature  
 Portuguese-Brazilian Literature

Romance Literatures

Rumanian Language and Literature

Russian Literature

Scottish Language and Literature

Spanish Literature

Spanish-American Literature

Swedish Language and Literature

Syriac Language and Literature

Turkish Language and Literature

Yiddish

**II. THE LITERARY FORMS.** The broadest subdivision in literature according to form is that into prose and poetry; and, though it is often very difficult to differentiate one from the other in fact, and always hard to describe the distinction between them in theory, the common definitions of prose as the ordinary mode of speech and poetry as speech figurative, cadenced, and cast within certain comparatively rigid forms, may be followed safely enough for practical purposes. Either, taken in itself, may be subdivided into forms of narrower connotation, such as essay and novel under prose, epic and lyric under poetry. Here, however, appears the inconsistency already mentioned as inherent in literary classification; for the earliest scientific essays of the Greeks were written in verse, while Walt Whitman's lyric spirit finds expression in a medium closely akin to Ruskin's fervid prose. Again, the drama is probably nowadays regarded as a prose form, though as a matter of fact the world's greatest plays bear the poetic form. Poetry, then, if we exclude the drama, embraces the two subdivisions of the epic and the lyric. In the history of literary development, poetry precedes

prose, and of the two poetic forms the epic, as a rule, antedates the lyric.

**1. EPIC POETRY.** The epic may be defined as a lengthy narrative in verse, dealing with a subject of great magnitude in character, national or descriptive of a great movement. A distinction may be made between the epic which is the spontaneous expression of national life, constructed at an early period in national development out of pre-existing minor poetic forms, and the artificial epic of a more advanced cultural stage, which is the work of a single mind and in consequence purposive in its nature rather than spontaneous. Mention should also be made of the mock or beast epic, in nature largely satirical. See **EPIC POETRY**; and, for the great epics and epic poets of the world's literature, the following titles:

**SANSKRIT:**

Mahabharata

Rāmāyana

Purana

**PERSIAN:**

Firdausi

Shah Namah

Rustam

**GREEK:**

Homer

Age of Epic Poetry (under Greek Literature)

Cyclic Poets

**LATIN:**

Vergil

Æneas

Lucan

Silius Italicus

Statius

**FRENCH:**

Chansons de geste

Roland

Aymon

SPANISH :

Cid, The

Ercilla y Zúñiga

GERMAN :

Nibelungenlied

Klopstock

ITALIAN :

Dante

Boiardo

Ariosto

Tasso

PORTUGUESE :

Camões

NORSE :

Edda

Saga

FINNISH :

Kalevala

ENGLISH :

Beowulf

Milton

THE BEAST EPIC :

Homer ; Greek Literature

Reynard the Fox

2. THE LYRIC. Lyric poetry, as the expression of personal feeling, is the most subjective of all literary forms. Originally written to be sung, the lyric has remained the nearest approach in literature to absolute music. Its scope is as wide as human emotion, broadening in the course of its development with the expansion of human sympathies. Its formal variations are numerous. See:

Lyric Poetry

Versification

Sonnet

Ode

Ballade

Rondeau

Madrigal

Canzone

Rhyme

Vers Libre

Lyric poetry attained great perfection in ancient Greece, though its field was narrower than that of modern poetry for comparative lack of the nature element, which, with us, is so conspicuous a feature of lyric expression. The Roman genius was, on the whole, unfavorable to the fostering of the lyric spirit. In the East, Persia produced a succession of poets of great excellence. See, for the great names in the realm of lyric poetry:

SANSKRIT :

Kalidasa

PERSIAN :

Nizami

Omar Khayyam

Sadi

Hafiz

Jāmi

LATIN :

Catullus

Tibullus

Horace

Ovid

Propertius

Ausonius

Prudentius

GREEK :

Alcman

Callinus

Archilochus

Tyrtæus

Simonides

Solon

Alcæus  
Sappho  
Anacreon  
Theognis  
Hipponax  
Pindar  
Bacchylides  
Timotheus  
Theocritus  
Bion  
Moschus  
Herondas

The lyric poetry of the Middle Ages was largely ecclesiastical, the Latin hymns of the period being especially marked by extraordinary effects of rhyme. The court singers of France and Germany, however, fostered the love theme assiduously. With the Revival of Learning came a great impetus to the poetic expression of secular emotions, Italy being the first to feel the impulse of the new movement. Lyricism languished during the domination of classical ideals in the seventeenth and eighteenth centuries, but, freed from the bond of artificiality, entered upon an unprecedented development towards the end of the latter century. See:

Hymnology  
Troubadours  
Trouvère  
Minnesinger  
Meistersinger  
Goliardic Literature  
Romanticism ;

and for the lyric poets of Western Europe:

#### FRENCH :

Marie de France  
Meung, Jean de  
Villon

Marot  
Malherbe  
Pléiade  
Ronsard  
Chénier, Andre Marie  
Chénier, Marie Joseph  
Béranger  
Lamartine  
Delavigne  
Hugo  
Musset  
Gautier  
Leconte de Lisle  
Baudelaire  
Hérédia, José  
Sully-Prudhomme  
Verlaine  
Mallarmé  
Regnier, H.  
Rimbaud, J. A.  
Kahn, Gustave

#### PROVENÇAL :

Roumanille  
Jasmin  
Mistral, F.  
Gras, Félix  
Félibrige

#### ITALIAN :

Cavalcanti, Guido  
Cino da Pistoja  
Dante  
Petrarch  
Colonna, Vittoria  
Guarini  
Marini  
Chiabrera  
Metastasio  
Bondi, Clemente  
Foscolo, Ugo  
Leopardi  
Monti, V.  
Aleardi  
Giusti, Giuseppe

Carducci

Graf, A.

SPANISH :

Lopez de Ayala, Pedro

Santillana

Carcilasso de la Vega

León, Luis de

Figucroa, Francisco de

Argensola

Mendoza, Diego Hurtado de

Góngora y Argote

Zorrilla y Moral

Iriarte y Oroposa

Lista y Aragon

Melendez Valdes

Espronceda

PORTUGUESE :

Ferreira, A.

Gomes de Amorim

GERMAN :

Walther von der Vogelweide

Sachs, Hans

Fleming, Paul

Opitz

Bürger

Kleist, E. C.

Goethe

Schiller

Schlegel, A. W.

Arndt

Novalis

Chamisso

Uhland

Körner

Eichendorff

Heine •

Rückert

Freiligrath

Bodenstedt

Scheffel

Auersperg

Hamerling

Ambrosius, Johanna

DUTCH :

Marnix

Vondel

Bilderdijk

Kate, J. J. ten

Eeden, F. Van

FLEMISH :

Maerlant

Bijns

Conscience, H.

The lyric poetry of Northern and Eastern Europe is recent in origin, dating from the eighteenth century. It has, as a rule, been under the influence of the great literary movements of the West, but, though largely mimetic in form, has been made the expression of national consciousness. See:

SWEDISH :

Bellman

Tegnér

Atterbom

Runeberg

Snoilsky

DANISH :

Heiberg, J. L.

Evald

Richardt

NORWEGIAN :

Welhaven

Wergeland

HUNGARIAN :

Kisfaludy

Arany

Petőfi

Erdélyi

RUSSIAN :

Derzhavin

Pushkin

Koltsov

Lermontov

Sheftchenko

Nekrasov

**POLISH:**

Naruszewicz  
Karpinski  
Mickiewicz  
Kniaznin  
Slowacki  
Krasinski  
Pol  
Asnyck

The origins of the English lyric poetry may be traced back, if it be so desired, to early Anglo-Saxon times. The continuous history begins with Chaucer. Some of the most beautiful lyrics of the language are embodied in the works of the Elizabethan dramatists, after whom, and Milton, the art declines and hardens until revived by Burns and Wordsworth. English lyric in the nineteenth century has covered the field of human sympathies, from Blake's unseen world to Tennyson's studies in evolution and Kipling's in machine construction. See:

**ENGLISH:**

Cædmon  
Ormulum  
Layamon  
Lydgate, John  
Minot, Laurence  
Barbour, John  
Gower  
Chaucer  
Sackville  
Shakespeare  
Jonson  
Milton  
Ramsay, Allan  
Donne  
Herrick  
Herbert  
Waller  
Crashaw

Cowley  
Vaughan  
Gay  
Savage, Richard  
Chatterton  
Shenstone  
Young, Edward  
Thomson  
Gray  
Collins  
Cowper  
Blake  
Burns  
Hogg  
Wordsworth  
Landor  
Moore  
Keats  
Shelley  
Præd  
Proctor, B. W.  
FitzGerald  
Tennyson  
Browning  
Clough  
Arnold, Matthew  
Ingelow, Jean  
Patmore  
Rossetti, Dante Gabriel  
Rossetti, Christina  
Morris  
Arnold, Edwin  
Swinburne  
Massey, G.  
Henley  
Watson, W.  
Kipling  
Meynell, A. C.  
Sharp, W.  
Yeats, W. B.

**AMERICAN:**

Freneau  
Barlow, Joel

Key  
 Halleck  
 Bryant  
 Drake  
 Emerson  
 Whittier  
 Longfellow  
 Holmes  
 Poe  
 Lowell  
 Hoffman, C. F.  
 Whitman  
 Cary, Alice and Phoebe  
 Timrod  
 Howe, Julia Ward  
 Stedman  
 Aldrich  
 Lanier  
 O'Reilly, J. B.  
 Field, Eugene  
 Riley  
 Miller, Joaquin  
 Moody, William Vaughan

3. THE DRAMA. The Drama has been placed high among mimetic forms, because of the contribution it lays on the other arts, thus combining within itself their several qualities. Action and character are the subject matter. The means are bodily motion, which gives the sculptor's effect; language, which is the instrument of the poet; music, and scenery, and costume, to which painting and architecture give their share. The origins of the drama are to be found, most probably, in early religious ceremonial. Festivals marked by singing and dancing, the latter more or less symbolic in character, are common to peoples in a primitive stage; and the line of progress is along the development of the action and the spoken dialogue, at the expense of the

chant, to complete secularization of the drama. The principles of the drama as propounded by Aristotle have remained for the most part the same; the mechanical technique has varied widely from original conditions. See:

Drama  
 Theatre  
 Stage  
 Chorus  
 Act  
 Ballet  
 Burlesque  
 Farce  
 Interlude  
 Masque  
 Vaudeville  
 Pantomime  
 Puppet  
 Atellanæ  
 Mime  
 Prologue  
 Epilogue

Greek drama had its origin in the worship of Dionysus. With Æschylus, tragedy is profoundly religious, and the actor's speeches are still subordinated to the choruses; Sophocles strengthened the element of action; Euripides thoroughly humanized tragedy. Attic comedy was fierce in personal satire and unbridled in speech. The Latin drama was sedulously modeled on the Greek. The origin of the Sanskrit drama is disputed, some deriving it from the Greek, others assigning it an independent development. See, for writers and plays:

SANSKRIT:  
 Śūdraka  
 Kalidasa  
 Bhavabhūti  
 Śakuntalā  
 Mricchakatika



**GREEK:**

Æschylus  
Phrynichus  
Sophocles  
Euripides  
Aristophanes  
Agathon  
Epicharmus  
Eupolis  
Menander

**LATIN:**

Plautus  
Terence  
Seneca

In Mediæval times, practically the only species of dramatic performance was the religious spectacles of the Church, in which the purpose was didactic. See: **MIRACLE PLAY**; **MORALITY**; **INTERLUDE**; **PASSION PLAY**.

Out of the religious performances of the Middle Ages the modern drama developed. In France, which served as a model to the Continent, an elaborate system of rules was built up, supposedly bringing the drama into conformity with the standards of the classic age. The classic ideals, with their restriction of human emotions to kings and nobles, were overthrown on the Continent in the first half of the nineteenth century, since when the scope of the drama has been widened to embrace the entire complex of society. Like the novel, the drama of the latest days has become largely purposive. See, for the writers:

**FRENCH:**

Mairet  
Regnard  
Corneille  
Racine  
Molière

**Marivaux**

Chénier, M. J.

Crébillon

Beaumarchais

Scribe

Vigny

Hugo

Legouvé

Labiche

Ponsard

Augier

Dumas

Pailleron

Meilhac

Halévy

Sardou

Rostand

Macterlinck

Brieux

Comédie Française

**ITALIAN:**

Trissino

Maffei

Goldoni

Gozzi

Alfieri

Manzoni

Giacometti

Annunzio, G. d'

**SPANISH:**

Encina

Vega Carpio

Calderon de la Barca

Moreto y Cabaña

Moratin, Leandro Fernández

Gil y Zárate

Lopez de Ayala, Adelardo

Hartzenbusch, J. E.

Echegaray

Breton de los Herreros

**PORTUGUESE:**

Sá de Miranda

Almeida-Garrett

The primacy in Continental drama, long held by the French, is disputed at the present day by the Teutons and the Slavs, more particularly the Scandinavian branch of the Teutons. See:

GERMAN:

Lessing  
Goethe  
Schiller  
Kotzebue  
Grillparzer  
Laube  
Gutzkow  
Anzengruber  
Heyse  
Sudermann  
Hauptmann  
Lindau, P.  
Hartleben  
Fulda

SWEDISH:

Almqvist  
Strindberg

DANISH:

Holberg  
Oehlenschläger

NORWEGIAN:

Ibsen  
Björnson

RUSSIAN:

Sumarokov  
Griboedov  
Gogol  
Ostrovski  
Zagoskin, M. N.  
Tolstoy, Alexei  
Tolstoy, Liov  
Gorky

POLISH:

Fredro  
Kniaznin  
Fredro the Younger

HUNGARIAN:

Kisfaludy, Károly  
Katona  
Szigligeti

While Continental Europe was enslaved by the rigid formulas of the classicists, in England the Romantic drama flourished from the beginning. The Elizabethan age is the golden age of the drama of the world. Following the Elizabethans came the decline, arrested partially by the talent of Dryden and Congreve during the Restoration, and of Goldsmith and Sheridan in the later part of the eighteenth century. In the nineteenth century, England brought forth no dramatic writer of conspicuous genius. See:

ENGLISH:

Udall  
Norton  
Sackville  
Kyd  
Lodge  
Peele  
Marston  
Greene  
Marlowe  
Shakespeare  
Nash  
Dekker  
Middleton  
Jonson  
Massinger  
Beaumont and Fletcher  
Ford  
Webster  
Davenant  
Dryden  
Wycherley  
Otway  
Congreve  
Farquhar  
Goldsmith

Sheridan  
 Knowles, J. S.  
 Beddoes, T. L.  
 Taylor, Tom  
 Robertson, T. W.  
 Sims, G. R.  
 Boucicault  
 Pinero  
 Jones, H. A.  
 Shaw, George Bernard  
 Phillips, Stephen  
 Barrie, J. M.  
 Galsworthy, John  
 Synge, J. M.  
 Masefield, John

## AMERICAN :

Dunlap, William  
 Payne, John Howard  
 Brougham, John  
 Boker  
 Sargent, Epes  
 Carleton, Henry Guy  
 Howard, Bronson  
 Campbell, Bartley  
 Thompson, Denman  
 Harrigan, Edward  
 Belasco, David  
 Fitch, William Clyde  
 Moody, William Vaughan

A partial list of the more noteworthy actors, of all times and all nations, is as follows:

Anderson, Mary A.  
 Archer, Belle  
 Arnould, Sophie  
 Arthur, Julia  
 Bancroft, Mary E. W.  
 Barrett, Wilson  
 Barry, Elizabeth  
 Barry, Spranger  
 Bates, Blanche  
 Bellamy, George Anne  
 Bernhardt, Sarah

Betterton, Thomas  
 Betty, W. H. W.  
 Booth, Agnes  
 Booth, Barton  
 Booth, Edwin  
 Booth, Junius Brutus  
 Bracegirdle, Anne  
 Burbage, Richard  
 Campbell, Beatrice  
 Clarke, J. S.  
 Clive, Catherine  
 Coghlan, Charles  
 Coghlan, Rose  
 Coquelin, B. C.  
 Crane, W. H.  
 Cushman, Charlotte  
 Davenport, E. L.  
 Davenport, Fanny  
 Déjazet, P. V.  
 Devrient, L.  
 Drew  
 Duse  
 Farren, Elizabeth  
 Fisher, Charles  
 Fiske, Minnie M.  
 Florence, W. J.  
 Forbes-Robertson, J.  
 Forrest, Edwin  
 Garrick, David  
 Gilbert, J. G.  
 Gillette, W. H.  
 Goodwin, N. C.  
 Haase, F.  
 Hackett, James H.  
 Hading, Jane  
 Hare, John  
 Haworth, Joseph  
 Herne, James A.  
 Irving, Henry  
 Janauschek, Fanny  
 Jordan, Dorothy  
 Kean, Edmund  
 Kean, C. J.  
 Kemble, Chas.

Kemble, Frances Anne  
 Kemble, John Philip  
 Kendal, Mr.  
 Kendal, Mrs.  
 Lecouvreur, Adrienne  
 Lemaître, A. L.  
 McCullough, J. E.  
 Macklin, Charles  
 Macready, W. C.  
 Mansfield, Richard  
 Mathews, Charles  
 Mathews, C. J.  
 Modjeska, H.  
 Morris, Clara  
 Mounet-Sully  
 Oldfield, Anne  
 Payne, J. H.  
 Placide, H.  
 Rachel, Mlle.  
 Rehan, Ada  
 Réjane, Mme.  
 Ristori, A.  
 Robson, Stuart  
 Roscius  
 Russell, Sol Smith  
 Salvini, A.  
 Salvini, T.  
 Siddons, Sarah  
 Sonnenthal, A.  
 Sothern, E. H.  
 Stoddart, J. H.  
 Thompson, Denman  
 Tree, Beerbohm  
 Vestris, Mme.  
 Wallack, J. L.  
 Wallack, J. W.  
 Willard, E. S.  
 Woffington, Margaret  
 Wyndham, Charles

4. THE NOVEL. The novel, at present the most flexible of literary forms, though of recent date in its present character, traces back to early and multiple sources. The beast tale,

common to all nations, the narrative of adventure, and the story of things supernatural, were the precursors of the novel. The love element becomes pronounced in the old Greek romances and assumes primary importance in the romances of the Middle Ages. The romance, it may be broadly put, passed into the novel, when the tale began to assume the character of a picture of contemporary life, a development to be assigned to the sixteenth century. See the article NOVEL.

The great monuments and figures of pre-modern story-telling are the following:

SANSKRIT:

Dandin  
 Subandhu  
 Bana

ARABIC:

Arabian Nights

GREEK AND ROMAN:

Heliodorus  
 Ephesiaca  
 Daphnis and Chloe  
 Apuleius  
 Apollonius of Tyre  
 Petronius

In Mediæval times, the romance flourished, combining in itself elements of the epic, the beast fable, and the tale of adventure and of love. Materials were largely drawn from ancient history, and the stories gathered around great figures of antiquity and the early Middle Ages. See:

Romance  
 Fabliaux  
 Gesta Romanorum  
 Alexander, Legend of  
 Charlemagne Cycle of Romances

Chrestien de Troyes  
 Wace  
 Roman de la Rose  
 Perceval  
 Tristram  
 Lancelot of the Lake  
 Malory  
 Grail, The Holy  
 Merlin  
 Chaucer  
 Morte d'Arthur  
 Euphues  
 Amadis of Gaul

Romance lacked characterization and reality. With the appearance of tales embodying observation of real types and description of manners, the novel as it is to-day begins. The origin is generally placed in Spain, where the rise of the picaresque tale marks the first step in character delineation. The subsequent development is rapid to present conditions, when the novel has become the all embracing term for all prose fiction, realistic, romantic, adventurous, or didactic. See for the writers:

#### FRENCH:

Scudéry, Madeleine de  
 Lafayette, Marie Madeleine de  
 Scarron  
 Lesage  
 Voltaire  
 Genlis, Countess de  
 Prévost d'Exiles  
 Saint-Pierre  
 Stendhal  
 Balzac  
 Hugo  
 Dumas, the Elder  
 Sue  
 Erckmann-Chatrian  
 Kock, Paul de

Sand, George  
 Merimée, P.  
 Flaubert  
 Goncourt  
 Feuillet  
 Daudet  
 Loti, Pierre  
 Zola  
 Bourget  
 Margueritte, P.  
 Prévost, E. M.  
 France, Anatole

#### ITALIAN:

Boccaccio  
 Manzoni  
 Amicis  
 Fogazzaro, A.  
 Verga, G.  
 Annunzio, Gabriele d'  
 Farina, S.  
 Scrao, Matilda

#### SPANISH:

Cervantes  
 Aleman  
 Valera y Alcalá Galiano  
 Galdos  
 Palacio Valdés  
 Alarcón  
 Pereda  
 Pardo Bazán

#### GERMAN:

Goethe  
 Fouqué  
 Gutzkow  
 Eichendorff  
 Alexis, W.  
 Hauff  
 Laube  
 Auerbach  
 Reuter, Fritz  
 Tieck, L.  
 Freytag  
 Storm, Theodor

Scheffel  
Gerstäcker  
Spielhagen  
Anzengruber  
Dahn  
Heyse  
Ebers  
Frenssen

## SWEDISH :

Rydberg  
Bremer, Frederika  
Strindberg

## DANISH :

Blicher  
Drachmann

## NORWEGIAN :

Björnson  
Lie  
Kielland

## HUNGARIAN :

Jókai  
Eötvös

## RUSSIAN :

Gontcharov  
Pisemski  
Gogol  
Turgenev  
Dostoyevsky  
Tolstoy  
Korolenko  
Gorky  
Chekhov

## POLISH :

Kraszewski  
Sienkiewicz  
Orzeszkowa

Defoe began the line of great English novelists with what is still the greatest story of adventure in our literature. Fielding then perfected the form. Manners were acutely

studied by a succession of women writers, who bridged the eighteenth and nineteenth centuries. Barren practically of the drama, the latter century found expression in the novel to as fully great an extent as in lyric poetry. See:

## ENGLISH :

Behn, Afra  
Defoe  
Sterne  
Smollett  
Fielding  
Richardson  
Inchbald, Elizabeth Simpson  
Godwin  
Burney, Frances  
Radcliffe, Ann  
Edgeworth, Maria  
Scott  
Austen, Jane  
Porter, Jane  
Peacock, Thomas Love  
Lover, Samuel  
Borrow  
Lever, Charles  
Bulwer-Lytton  
Gaskell, Elizabeth  
James, G. P. R.  
Thackeray  
Marryat, Frederick  
Dickens  
Reade  
Trollope  
Kingsley, Charles  
Eliot, George  
Brontë, (Charlotte, Emily, Anne)  
Collins, Wilkie  
Blackmore  
Oliphant, Margaret  
Meredith, George  
Morris, William  
Du Maurier  
Black, William

Hardy, Thomas  
 Stevenson, Robert Louis  
 Russell, W. C.  
 Ward, Mrs. Humphry  
 Moore, George  
 Hawkins, Anthony Hope  
 Kipling, Rudyard  
 Conrad, Joseph  
 Gissing, George  
 Hewlett, Maurice  
 Quiller-Couch, A. T.  
 Wells, H. G.  
 Bennett, Arnold  
 Galsworthy, John

The nineteenth century produced in America in the realm of fiction a master romancer, Cooper, two masters in their art, Hawthorne and Poe, and at least two talented exponents of modern realism, James and Howells. See:

Brown, Charles Brockden  
 Cooper  
 Poe  
 Hawthorne  
 Hale, E. E.  
 Howells  
 Harte, Bret  
 James, Henry  
 Cable, George Washington  
 Fawcett, Edgar  
 Grant, Robert  
 Jackson, H. H.  
 Melville, Herman  
 Tourgee, A. W.  
 Wilkins, Mary  
 Allen, James Lane  
 Page, Thomas Nelson  
 Garland, Hamlin  
 Stockton, Frank R.  
 Norris, Frank  
 Atherton, Gertrude  
 Wharton, Edith

## 5. CRITICISM AND ESSAY.

1. The principles underlying artistic endeavor have been discussed since early Greek times, and may be divided into two classes, the universal laws of artistic expression, which have always been accepted, and the minor theories, more limited in scope and applying generally to individual arts, which never have been accepted by all, and never will be. Plato first studied in a thorough manner the relations of art to reality. Aristotle's *Poetics* laid down the principles that have undergone no essential change since his time. On the other hand, the blending of the classic spirit with the Teutonic, and the subsequent rise of chivalry and romance, produced differences of opinion regarding subject, scope, and manner that are in full force at the present day. See:

Criticism  
 Realism and Naturalism  
 Romanticism  
 Impressionist School of Painting  
 Décadents  
 Symbolists

2. Criticism in the beginning found expression in both prose and verse; the modern tendency has been decidedly towards prose, though there is not wanting a Pope's *Essay on Criticism* to continue the succession from Horace's *Ars Poetica*. The usual form, then, in which criticism at present finds expression is the Essay. See: ESSAY, and for the writers:

GREEK:  
 Plato  
 Aristotle  
 Plutarch  
 Longinus

**LATIN :**

Cicero  
 Horace  
 Seneca the Elder  
 Varro  
 Pliny  
 Quintilian

**FRENCH :**

Montaigne  
 Saint-Évremond  
 Corneille  
 Boileau  
 Voltaire  
 Diderot  
 Bayle  
 Taine  
 Cousin  
 Lamartine  
 Sainte-Beuve  
 Michelet  
 Sarcey  
 France, Anatole  
 Faguet, Émile  
 Brunetière  
 Lemaître, Jules  
 Gourmont, Rémy de

**ITALIAN :**

Dante  
 Boccaccio  
 Poliziano  
 Vida  
 Scaliger, J. C.  
 Carducci, Giosuè  
 De Sanctis, F.  
 Gubernatis, A.  
 Croce, B.

**GERMAN :**

Reuchlin  
 Winckelmann  
 Gottsched  
 Herder  
 Lessing  
 Schiller

Schlegel, Friedrich

Grimm

Scherer, W.

Menzel

Bahr, Hermann

Nordau, Max

**DUTCH :**

Erasmus

**DANISH :**

Rafn

Brandes

**RUSSIAN :**

Belinsky

Pisarev

**ENGLISH :**

Ascham

Sidney

Bacon, Francis

Dryden

Steele

Addison

Swift

Johnson

Pope

Jeffrey

Coleridge

Wordsworth

Lamb

Hazlitt

Wilson, John

De Quincey

Hunt, J. H. Leigh

Carlyle

Ruskin

Arnold, Matthew

Rossetti, W. M.

Stevenson, Robert Louis

Pater, W.

Symonds, J. A.

Saintsbury, George

Stephen, Leslie

Dowden, Edward

Archer, William



Gosse, Edmund  
Shaw, G. B.

## AMERICAN :

Irving  
Emerson  
Ticknor, G.  
Lowell  
Fuller, Sarah Margaret  
Curtis, G. W.  
Whipple  
White, Richard Grant  
Hutton, Laurence  
Mabie, Hamilton  
Woodberry, George Edward  
Winter, William

## 6. MORALISTS, SATIRISTS, AND HUMORISTS.

The study of human character and conduct has at all times received the attention of great minds, and what may be called ethical literature forms a very important part of the literature of the world. Near to constructive moralists, like Epictetus or Carlyle, stands the satirist, whose mission it is to combat the evil of degenerate times. The contemplation of the petty faults and incongruities of human character and action, so portrayed as to arouse laughter without arousing deep emotion of any kind, has always been a universal source of amusement. See:

## GREEK AND ROMAN :

Aristophanes  
Lucian  
Epictetus  
Ennius  
Lucilius  
Horace  
Juvenal  
Martial  
Persius  
Lucan

Tacitus  
Petronius  
Aurelius, Marcus

## FRENCH :

Rabelais  
Ménippée  
La Bruyère  
La Rochefoucauld  
Pascal  
Lesage  
Voltaire  
Chamfort, S. R.  
France, Anatole

## ITALIAN :

Jacopone da Todi  
Aretino

## SPANISH :

Quevedo y Villegas

## GERMAN :

Fischart, Johannes  
Brant  
Hutten, Ulrich von  
Epistolæ Obscurorum Virorum  
Grimmelshausen  
Rabener  
Lichtenberg  
Wieland  
Tieck  
Richter, Johann Paul  
Reuter, Fritz

## DUTCH :

Erasmus  
Marnix

## RUSSIAN :

Kantemir  
Shtchedrin  
Nekrasov

## ENGLISH :

Langland (Piers Plowman)  
Skelton  
Bunyan  
Butler

Dryden  
 Pope  
 Swift  
 Junius, Letters of  
 Arbuthnot  
 Byron  
 Carlyle  
 Smith, Sydney  
 Thackeray  
 Dickens  
 Calverley  
 Gilbert, W. S.  
 Mallock, W. H.  
 Lear, Edward  
 Jerome, Jerome K.  
 Shaw, G. B.

## SCOTCH:

Dunbar  
 Barclay

## AMERICAN:

Ward, Nathaniel  
 Franklin  
 Irving  
 Lowell  
 Holmes  
 Smith, Seba  
 Clemens, S.  
 Leland, C. G.  
 Locke, D. R.  
 Browne, C. F.  
 Bunner, H. C.  
 Shaw, H. W.  
 Stockton, F. R.  
 Nye, E. W.  
 Dunne, Finley Peter

## 7. ORATORY.

The art of eloquent persuasion is found among all primitive peoples where social bonds have become of some importance. Oratory attains its fullest development in the Greek democracies, where the citizen was called upon to take so considerable a share in the

public life. The political and juristic genius of the Roman was likewise favorable to the development of the art. Pulpit eloquence had some of its greatest masters among the early Fathers of the Church, which has never been wanting in masterly exponents of its doctrines. A great period in the history of oratory was the age of the French Revolution, when, contemporaneously in England too, a succession of great orators lent lustre to the reign of George III. In the United States, the revolutionary period, and the period of rapid national growth, produced a brilliant series of orators, culminating in the classic triad, Clay, Webster, and Calhoun. At present oratory may be considered a declining art, especially as related to secular affairs; and, though its power over the multitude may still be felt in electoral campaigns, its influence in legislative bodies has largely passed away. See ORATORY; and, for the great orators of all ages:

## GREEK:

Pericles  
 Gorgias  
 Isocrates  
 Lysias  
 Andocides  
 Isæus  
 Æschines  
 Demosthenes  
 Athanasius  
 Chrysostom  
 Basil the Great

## ROMAN:

Cato of Utica  
 Hortensius  
 Cicero  
 Ambrose

**FRENCH :**

Bossuet  
 Bourdaloue  
 Massillon  
 Fénelon  
 Mirabeau  
 Barnave  
 Vergniaud  
 Guadet  
 Danton  
 Robespierre  
 Royer-Collard  
 Lamartine  
 Lacordaire  
 Thiers  
 Gambetta  
 Jaurès, J. L.

**ITALIAN :**

Mazzini

**SPANISH :**

Castelar

**HUNGARIAN :**

Kossuth

**ENGLISH :**

Taylor, Jeremy  
 Baxter, Richard  
 Whitefield  
 Mansfield  
 Burke  
 Pitt, the Elder  
 Pitt, the Younger  
 Fox, C. J.  
 Sheridan, R. B.  
 Erskine, Lord  
 Canning  
 Bright, John  
 Gladstone  
 Drummond, Henry  
 Spurgeon, C. H.

**IRISH :**

Curran  
 Grattan

**O'Connell**

Emmet

**AMERICAN :**

Otis, James  
 Henry, Patrick  
 Lee, Richard Henry  
 Ames, Fisher  
 Channing, W. E.  
 Randolph, John  
 Wirt, William  
 Benton  
 Clay  
 Webster  
 Calhoun  
 Hayne  
 Everett  
 Choate, Rufus  
 Seward, W. H.  
 Sumner, Charles  
 Stephens, Alexander  
 Beecher, H. W.  
 Douglas, Stephen A.  
 Evarts, W. M.  
 Edmunds, George  
 Conkling, Roscoe  
 Ingersoll, Robert  
 Brooks, Phillips  
 Bryan, William Jennings  
 Choate, Joseph H.

**8. THE FABLE.**

Probably it was the inhabitants of India who first ascribed human wisdom and language to animals. From India the fable passed westward, and, beginning with the Greek *Æsop*, we find practically the same scheme and contents in all European fabulists. See:

**INDIA :**

Pancatantra  
 Bidpai

**ARABIAN :**

Lokman

**GREEK :**

Æsop

**LATIN :**

Phædrus

**FRENCH :**

Marot

La Fontaine

Perrault

Florian

Laboulaye

**RUSSIAN :**

Krylov

**GERMAN :**

Hagedorn

Gellert

Lessing

Grimm

**NORWEGIAN :**

Asbjørnsen

Moe

**DANISH :**

Andersen

**ENGLISH :**

Gay

**9. PERSONAL LITERATURE.**

This name may be applied to such productions as diaries, memoirs, letters, and "confessions" of distinguished men and women, or men and women whose experiences in life have been extraordinary. Written, it may be presumed, for the purpose of self-expression, they are valuable indexes of character, motives, and causes. See:

Letters in Literature

Aurelius, Marcus: Meditations

Augustine: Confessions

Sévigné, Marquise de

Saint-Simon: Mémoires

Rousseau: Confessions

Senancour: Obermann

Amiel

Selden: Table Talk

Pepys

Evelyn

Walpole, Horace

Chesterfield

**10. JOURNALISM.**

The press, which must be regarded as an important element in the literary life of any nation, may be studied under the following heads:

Periodical Literature

Journalism, College

Newspaper

Punch

Figaro

Times, The

Printing

A partial list of noteworthy names in journalism is as follows:

About, Edmond

Blowitz, Henri Georges

Bonner, Robert

Bowles, Samuel

Creelman, James

Curtis, W. E.

Dana, C. A.

Forbes, Archibald

Godkin, E. L.

Greeley, Horace

Halstead, Murat

Harden, Maximilian

Kennan, George

Labouchère, Henry

Lemon, Mark

Norman, Henry

Northcliffe, Lord

Pulitzer, Joseph

Raymond, H. J.

Reid, Whitelaw

Rocheftort, Henri

Russell, W. H.

Sala, G. A. H.

Smalley, G. W.  
Stanley, H. M.  
Stead, W. T.  
Steevens, G. W.  
Taylor, Bayard  
Traill, H. D.  
Villiers, F.  
Watterson, Henry  
Weed, Thurlow  
White, Horace  
Wilkinson, H. S.  
Young, J. R.

11. MISCELLANEOUS TITLES.

Manuscript  
Manuscripts, Illumination of

Papyrus  
Palimpsest  
Paleography  
Codex  
Coster  
Gutenberg  
Fust  
Elzevir  
Manutius  
Foulis  
Encyclopædia  
Dictionary  
Larousse  
Brockhaus  
Copyright  
Literary Property

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# Chapter 10. The Fine Arts

## (Architecture)

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**T**HE study of the fine arts may be approached from one of three different points of view. The first of these is the historical, in which the student desires to obtain a comprehensive view of the art of a nation or of an entire period, its general characteristics and development. Another is the artistic, in which knowledge of a particular art or of some of its aspects is desired. A third is the biographical, in which the interest centres about an individual artist. To meet the first point of view, the *New International Encyclopædia* contains general articles treating the architecture, sculpture, painting, and minor arts of certain nations and periods. These general articles may best be divided into two groups: those treating the art of Oriental nations, whose artistic development is remotely or not at all concerned with the general European evolution; and those dealing with the great periods of artistic development participated in by the Occident in general. This division obviates the necessity for general articles on the art of separate European countries, as, for instance, French art, which will be found treated under ROMANESQUE, GOTHIC, and RENAISSANCE ART, and in the general articles ARCHITECTURE, SCULPTURE, PAINTING. The artist's point of view is represented by general articles on Painting, Sculpture, and Architecture, and by articles on the various schools, and on technical terms and processes. The biographical side is fully dealt with in the lives of all the principal artists. The art museums are usually described under the titles of the cities in which they are situated; but a few are of sufficient importance to require separate articles. The principal schools of design are described in the general article upon that subject and in special articles on the more important schools. The description of celebrated representations in painting and sculpture is usually given in the biography of the artist who produced them. The article MYTHOLOGY IN ART gives a general treatment of such representations in Classic Art, which are further treated under the names of the subjects represented, as JUPITER, HERCULES, ACHILLES. The article ICONOGRAPHY similarly treats Christian Art, and there are special articles on a number of important themes of artistic treatment, such as CHRIST IN ART and MADONNA.

### A. General Articles

#### I. INTRODUCTORY:

Art  
Art, Primitive  
Æsthetics

#### II. ORIENTAL ART:

Egyptian Art  
Babylonian Art

Assyrian Art  
Jewish Art  
Phœnician Art  
Mohammedan Art  
Persian Art  
Indian Art  
Chinese Art  
Japanese Art

## III. EUROPEAN DEVELOPMENT:

Greek Art  
 Etruria  
 Roman Art  
 Christian Art  
 Byzantine Art  
 Monastic Art  
 Romanesque Art  
 Lombard Art  
 Gothic Art  
 Renaissance Art

## IV. ART MUSEUMS, SOCIETIES, AND SCHOOLS:

Design, Schools of  
 École des Beaux-Arts  
 National Academy of Design  
 Society of American Artists  
 Royal Academy of Arts  
 Saint Luke, Academy of  
 British Museum  
 Louvre  
 Luxembourg Palace  
 Pitti Palace  
 Uffizi

## B. Architecture

In its widest sense, Architecture includes any kind of construction; but, in the *New International Encyclopædia*, the term is usually restricted to building which attains the dignity of art. Purely technical and utilitarian phases of architecture are treated under BUILDING, FIREPROOF CONSTRUCTION, MASONRY, and similar titles. (See the chapter on Manufactures and Engineering.) The three principal varieties of architecture are civil, religious, and military; and under these heads will be found their chief subdivisions. A few of these call for more detailed treatment of the component parts, and these are best enumerated below in connection with that style under which they were principally developed; as, for instance, TEMPLE under Greek Architecture, CHURCH under Early Christian, MONASTERY and CASTLE under Romanesque. Most celebrated works of architecture are treated in the articles on those cities in which they are situated; but a number of buildings of especial interest are

treated separately, and in the following scheme of study, such buildings are enumerated under the different styles of architecture of which they are representative. For example, PARTHENON, ERECHTHEUM, etc., appear under Greek Architecture, NOTRE DAME DE PARIS and WESTMINSTER ABBEY under Gothic.

## I. CIVIL ARCHITECTURE:

Municipal Architecture  
 Forum  
 Palace  
 Fountain  
 Villa  
 Mausoleum  
 Theatre  
 Amphitheatre  
 Circus  
 Bath  
 Town Hall  
 Arch, Triumphal  
 Aqueduct  
 Bridge

## II. RELIGIOUS ARCHITECTURE:

Temple

Church  
Cathedral  
Monastery  
Oratory  
Baptistery

### III. MILITARY ARCHITECTURE:

Acropolis  
Citadel  
Castle  
Camp  
Fortification

### IV. TECHNICAL TERMS.

A large number of architectural terms deserve special treatment. Some of these, which are general in their application, are enumerated below, while others, the application of which is restricted to a particular style, are enumerated under that style; as, for example, MOSQUE under Mohammedan. See:

Arabesque  
Arcade  
Arch  
Balcony  
Balustrade  
Bay Window  
Belfry  
Ceiling  
Colonnade  
Column  
Cupola  
Dome  
Door  
Doorway  
Façade  
Floor  
Hall  
Molding  
Orders of Architecture  
Ornament  
Panel

Pendentive  
Pilaster  
Pillar  
Porch  
Portal  
Roof  
Spire  
Tower  
Tracery  
Window

### V. HISTORIC STYLES AND BIOGRAPHY.

Architecture is the most ancient and, perhaps, the most important of the fine arts. In most artistic developments, both painting and sculpture have been subordinate to it. Its historical treatment, therefore, forms an extensive and important part of the general department of architecture in the *Encyclopædia*. A general historical sketch of its development, from the most ancient times to the present, is given in the article ARCHITECTURE. This should be supplemented by the copious articles on the great historic styles, with the biographical additions given in the following list. Our treatment will outline the salient features of the different styles, beginning with those Oriental nations whose architecture lies remote from the European development—such as China, India, and Japan. We then proceed to those ancient nations, like Babylonia and Egypt, which materially influenced the Greek architecture. From Greek architecture, is descended the Roman, and from the Roman, the Mediæval and Renaissance styles, and finally the architecture of the present day.

#### 1. *India.*

The architecture of India begins with the Buddhist style (B. C. 300-A. D.



700), whose buildings are of three classes: stupa or tope (a mound enclosing a relic); rock temples (chaityas); and monasteries (viharas). The Neo-Brahmanic style (beginning A. D. 700) comprises many varieties, including the so-called Jaina and Dravidian. It developed the architectural detail, the over-rich ornamentation, the pagodas and gopuras of the South. The Mohammedan architecture of India, differing materially from these styles, is best treated under MOHAMMEDAN ART. See:

Indian Art  
Tope  
Vihāra  
Ellora  
Vijayanagara  
Boro Buddor  
Elephanta  
Mohammedan Art

## 2. *China and Japan.*

The most characteristic feature of Chinese architecture, which begins in the first century B. C., after the advent of Buddhism, is the tiled roof of tent-like form. Others are the pagoda, the pail-loo (a monumental gateway), and elaborately colored surface decoration. Japanese architecture, which begins with the seventh century A. D., is even less massive. It makes more of timber construction, and spends more upon roof effects than the Chinese. See:

Chinese Art  
Japanese Art  
Pagoda

## 3. *Babylonia and Assyria.*

The earliest dated architectural remains are those of the Babylonians, from as far back as B. C. 6000. Their build-

ing material was brick, and they were the first to construct vaults and arches. Their most important buildings were the temples, which were stepped pyramids of great height, brilliantly colored with glazed tiles. Their city walls were of amazing height and thickness.

Assyrian architecture was derived from the Babylonian, but was more secular in character, the chief buildings being the royal palaces, in which it perfected decorative relief sculpture of a high order. See:

- (a) Babylonian Art
  - Babylon
  - Babel, Tower of
  - Nippur
  - Erech
  - Ur
- (b) Assyrian Art
  - Nineveh
  - Nimrud
  - Khorsabad
  - Koyunjik

## 4. *Persia, Phœnicia, Judea.*

The Babylonian-Assyrian influence was determinative for the architecture of the Hittites, and for the utilitarian art of the Phœnicians, who built for Solomon the Temple at Jerusalem. Ancient Persian architecture shows a mingling of Babylonian with Egyptian and Greek influences; but, under the Parthian and Sassanian dynasties, it reverted to purer Oriental types. See:

Hittites  
Phœnician Art  
Jewish Art  
Temple at Jerusalem  
Persian Art  
Ecbatana  
Susa

Pasargadæ  
Firuzabad

### 5. *Egypt.*

The architectural monuments of the Old Empire (B. C. 4500-2160) are chiefly sepulchral—pyramids, mastabas, and tomb-temples. Temple architecture took on a new development with the Middle Empire (B. C. 2160-1788), and attained its highest development under the New Empire (B. C. 1588-1150), which followed the disastrous interruption of the Hyksos invasion. After a long decline, there was a brilliant revival under the Ptolemies in the third century B. C. The temples were often, like the Ramesseum, sepulchral; some were rock-cut, as at Abu-Simbel; some partly hewn and partly constructed, as at Deir-el-Bahri. The greatest temples are those of Karnak, Luxor, Medinet-Habu, Abydos, the Ramesseum, and the Ptolemææ and Roman temples of Denderah, Philæ, and Edfu. For descriptions, consult the section *Architecture*, under EGYPTIAN ART. See:

#### Egyptian Art

Pyramid  
Mastaba  
Mêdûm  
Luxor  
Thebes  
Karnak  
Edfu  
Elephantine  
Abu-Simbel  
Deir-el-Bahri  
Ramesseum  
Medînet Habu  
Denderah  
Philæ  
Beni-Hassan

### 6. *Greece.*

The Mycenæan architecture in Greek lands, sometimes known as the Ægean style, is described under ARCHÆOLOGY, and in the articles on the principal sites of this culture. From the main hall of the Mycenæan palace was evolved that marvelous structural masterpiece, the Greek Temple, the final type of which appears in the seventh century B. C. For a description of this temple, which is the central figure of Greek architecture, consult GREEK ART. The origin and development of the two principal styles of temple architecture, Doric and Ionic, are treated under ARCHITECTURE and ARCHÆOLOGY. The earliest examples of the Doric are in Sicily and Southern Italy, and it attained perfection during the fifth century, in buildings like the Parthenon and Theseum at Athens, and in the temples of Pæstum. The Ionic order was increasingly used in the fourth century B. C., as at Miletus and Ephesus, the Corinthian being as yet used for small monuments only. The Hellenistic age saw a great development of architecture of a private, civil, and sepulchral character, like the stoa, propylæa, theatre, odeon, and mausoleum.

#### (a) General Titles:

Cyclopean Architecture  
Archæology  
Greek Art  
Temple  
Doric Order  
Ionic Order  
Corinthian Order  
Column  
Fluting  
Entablature  
Base

Pediment  
 Frieze  
 Cornice  
 Acanthus  
 Pæstum  
 Agrigentum  
 Selinus  
 Segesta  
 Parthenon  
 Theseum  
 Erectheum  
 Phigalia  
 Miletus  
 Diana, Temple of  
 Teos  
 Magnesia

(b) Civil Architecture:

Propylæa  
 Stoa  
 Colonnade  
 Stadium  
 Theatre  
 Mausoleum  
 Choragic Monument

(c) Biography:

Ictinus  
 Callicrates  
 Mnesicles

7. *Rome.*

For a general view of Roman architecture, the student is referred to **ROMAN ART**. The early architecture of Rome is practically Etruscan, and to this people the Romans owe their knowledge of vaulting and the arch. At the close of the republican epoch, they adopted Greek orders, evincing special preference for the Corinthian, which they developed into an independent order, and from which they evolved the so-called composite. These forms were decoratively used as adjuncts of con-

struction. The principal works of Roman architecture were great civil structures, like the fora, triumphal arches, amphitheatres, thermæ, aqueducts, besides many superb temples. The highest development was during the first 150 years of the empire, after which came the decline. See:

(a) Etruria (section on Art)

Cloaca  
 Roman Art  
 Aqueduct  
 Tabularium  
 Forum  
 Trajan, Forum of  
 Basilica  
 Pantheon  
 Theatre  
 Amphitheatre  
 Arch, Triumphal  
 Trajan, Arch of  
 Titus, Arch of  
 Constantine, Arch of  
 Septimius Severus, Arch of  
 Antonine Column  
 Caracalla, Baths of  
 Diocletian, Baths of  
 Tivoli  
 Pompeii  
 Herculaneum  
 Baalbek  
 Palmyra

(b) Biography:

Apollodorus

8. *Early Christian.*

Early Christian architecture is an adaptation of the declining Roman to the needs of Christian worship. The requirement was a large interior for many worshipers, resulting in the development of the basilical construction, which became typical for church build-

ing. The component parts of the basilica are discussed in the articles listed below under Basilical Construction. The article CHURCH gives the general development of the church building. To this is added a list of other terms of ecclesiastical architecture.

(a) Basilical Construction:

Basilica  
Apse  
Transept  
Atrium  
Nave  
Altar  
Choir  
Confessional

(b) Church, etc.:

Church  
Catacombs  
Chancel  
Chapel  
Crypt  
Font  
Reredos  
Sacristy

9. *Byzantine*.

In the eastern half of the Roman Empire, the Byzantines developed the domical construction, inventing the pendentives to support the dome. Byzantine architecture was also characterized by rich mosaic decoration. Its great masterpieces are the Church of Saint Sophia at Constantinople and Saint Mark's at Venice. It prevailed throughout the Eastern Empire until its destruction by the Turks; in Southern Italy, Sicily, Venice, and Ravenna; in Armenia, the Balkans, and wherever else the Greek Church prevailed. Russian architecture is a development of the Byzantine. See:

Byzantine Art

Mosaic  
Dome  
Pendentive  
Saint Sophia  
Saint Mark's Church  
Anthemius (of Tralles)

10. *Mohammedan*.

Coincident with the Mohammedan conquests, a style of architecture arose based upon the Byzantine and Persian. Its golden age began with the tenth century, and the final types were attained in the eleventh. The ultimate type of the mosque was built on the court-plan, with pointed arches, highly colored geometrical ornament, and dome vaulting. The principal schools were the Moorish (Spain), Egyptian, Turkish, Persian, and the Mohammedan styles that grew up in India. All these are described in MOHAMMEDAN ART, besides which there are articles upon the most prominent features of Mohammedan architecture. See:

Mohammedan Art  
Mosque  
Minaret  
Tekiyé  
Bazar  
Caravanserai  
Alhambra  
Taj Mahal

11. *Romanesque* (A. D. 800-1200).

In Middle and Western Europe, Early Christian architecture was succeeded by the Romanesque, which was pre-eminently the art of the monastic orders and of feudalism. Among its innovations were the cruciform plan, the developed crypt, and the incorporation of bell-towers with the church building. But the principal achieve-

ment of Romanesque architecture was the perfection of vaulting,—the dome and tunnel vault in Southern France, and the groined vault in Lombardy, the Rhinelands, Normandy, and England. It thus led the way to the development of the pointed arch and Gothic architecture. The basis of the study of Romanesque architecture should be the appropriate section of ROMANESQUE ART. See:

Romanesque Art  
Lombard Art  
Norman Architecture  
Vault  
Crypt  
Bell-Tower  
Castle  
Keep  
Bailey  
Tower  
Bastion  
Barbican  
Wartburg  
Monastery  
Cloister  
Chapter-house  
Dormitory

## 12. Gothic.

Gothic architecture is the development of Romanesque groined vaulting. By means of the pointed arch, the most characteristic feature of the system, the vertical strains are concentrated in powerful piers, the horizontal thrusts on flying buttresses, permitting light walls, huge windows and an infinite wealth of statuary and tracery. Gothic architecture originated in France in the twelfth century, and there it also attained its most perfect development in the thirteenth, declining into the Flamboyant style of the fifteenth century.

Spanish Gothic of the thirteenth century is second only to the French, though later debased by too much ornament. In England, a peculiarly national style arose, which should be studied under the headings by which three varieties are usually known, EARLY ENGLISH, DECORATED, and PERPENDICULAR. At its best, the German Gothic is noted for its beautiful tracery and spires. In Italy, the Gothic style is purely decorative, and it produced a charming style of civic buildings, especially in Tuscany and Venice. The basis of study should be the article, GOTHIC ARCHITECTURE, supplemented by the articles on special churches, and the descriptions in the articles on the cities, a few of which are appended. See:

### (a) Gothic Architecture

Vault  
Flamboyant  
Early English  
Decorated Style  
Perpendicular  
Fan-Tracery Vaulting  
Notre Dame de Paris  
Sainte Chapelle  
Westminster Abbey  
Santa Croce

### (b) Cathedral Cities:

Rheims  
Amiens  
Burgos  
Lincoln  
Salisbury  
York  
Canterbury  
Winchester  
Cologne  
Strassburg  
Nuremburg

Freiburg  
Milan  
Florence  
Siena  
Orvieto

(c) Biography:

Montreuil, Pierre de  
William of Wykeham  
Erwin  
Arnolfo di Cambio

13. *Renaissance.*

(a) Italy.

Renaissance architecture is the adaptation of classical forms, as they survived in Roman remains, to the architectural needs of the day. The Early Renaissance (fifteenth century) originated in the works of Brunelleschi at Florence, whence it was introduced into the rest of Italy. Its work was decorative in character, the constructive side being rather developed by the Roman school, headed by Bramante. The tendency was increasingly towards the formal classicism evinced in the works of Palladio and Vignola. As a reaction, came the freer but exaggerated Barocco of the seventeenth and eighteenth centuries. The basis of study should be the section *Architecture*, under RENAISSANCE ART.

(i) Prominent Buildings:

Certosa  
Doge's Palace  
Pitti Palace  
Lante, Villa  
Villa, Giulia  
Saint Peter's Church

(ii) Biography:

Brunelleschi, Filippo  
Michelozzi, Michelozzo

Alberti, Leone Battista  
Giuliano da Majano  
Laurana, Luciano da  
Sangallo  
Bramante, Donato d'Agnolo  
Peruzzi, Baldassare  
Sansovino, Jacopo  
Michelangelo  
Vignola, Giacomo Barozzo da  
Palladio, Andrea  
Serlio, Sebastiano  
Scamozzi, Vincenzo  
Fontana, Domenico  
Maderna, Carlo  
Bernini, Giovanni Lorenzo  
Borromini, Francesco  
Ammanati, Bartolommeo  
Longhena, Baldassare

(b) Other Countries.

Outside of Italy, the most important development of Renaissance architecture was the French. Its most original type was the mediæval castle transformed into the palace of the Renaissance. There was constant influence from Italy, but the later French Barocco is superior to the Italian. In Germany, the Gothic elements survived late, and materially influenced the incoming Renaissance. A similar development occurred in other European countries. Spain made use of much elaborate decorative detail. The Renaissance appeared latest of all in England in the seventeenth century. A kind of Palladian High Renaissance, adopted by Inigo Jones, and developed by Wren, retained a purifying influence during the eighteenth century, until the advent of classic revival.

(i) France:

Palace  
Chambiges, Martin

Bullant, Jean  
 De l'Orme, Philibert  
 Lescot, Pierre  
 Brosse, Salomon de  
 Mansart  
 Fontainebleau  
 Louvre  
 Tuileries  
 Luxembourg Palace

(ii) Great Britain:

Jones, Inigo  
 Wren, Sir Christopher  
 Van Brugh, Sir John  
 Hawksmoor, Nicholas  
 Chambers, Sir William  
 Nash, Sir John  
 Dance, George  
 Saint Paul's Cathedral  
 Whitehall

14. *Nineteenth Century.*

The reaction against the exaggerated styles of the eighteenth century was an imitation of classical forms. In France, Roman forms were predominant in the great structures of the Republic and first Empire; but, in England and Germany, Greek forms were more closely followed. About 1830 came the Gothic revival, which attained especial development in England, in such buildings as the Houses of Parliament and numberless churches. The present tendency is towards Renaissance forms and greater freedom from tradition.

The tasteful colonial architecture of the United States followed English models, but the early republic adopted the classic revival (Capitol). The period of the Civil War (till 1870) was singularly unfruitful; but between 1870 and 1880 there was a revival of the artistic spirit. The problem of

the artistic treatment of the skyscraper with the steel-frame construction is as yet unsolved; but constant improvement is being made. The basis of study should be the section on the *Nineteenth Century*.

(a) France:

Soufflot, Jacques Germain  
 Percier, Charles  
 Fontaine, P. F. L.  
 Viollet-le-Duc  
 Visconti, L. T. J.  
 Garnier, J. L. C.

(b) Germany and Austria:

Gärtner, Friedrich von  
 Schinkel, Karl Friedrich  
 Klenze, Leo von  
 Hansen, Theophilus von  
 Semper, Gottfried

(c) Great Britain:

Soane, Sir John  
 Smirke, Sir Robert  
 Pugin, Augustus  
 Pugin, Augustus N. M.  
 Wyatt, Sir Matthew D.  
 Fergusson, James  
 Scott, Sir George Gilbert  
 Street, George Edmund  
 Barry, Sir Charles  
 Waterhouse, Alfred  
 Paxton, Sir Joseph  
 Parliament, Houses of

(d) United States:

Latrobe, Benjamin Henry  
 Bulfinch, Charles  
 Walter, Thomas Ustick  
 Renwick, James  
 Upjohn, Richard  
 Hunt, Richard Morris  
 Richardson, H. H.  
 McKim, Charles F.

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# Chapter 11. The Fine Arts

## (Sculpture and Painting)

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(Read general introduction at the opening of preceding chapter.)

### A. Sculpture

The study of sculpture centres about the general article on that subject. In this article will be found sections on the technical processes and materials, especially the modern, and on the different forms of sculpture, and a sketch of the history of sculpture, containing a description of the characteristics and the development of the different schools, as revealed in their principal artists. The study of the technical forms and processes of sculpture should be supplemented by the special articles enumerated below, which also contain historical sketches of these subjects; that of the history by those on the different schools and epochs of art, and above all by the biographies of the artists, some of which are enumerated below.

#### I. BRANCHES AND TECHNIQUE OF SCULPTURE.

- Carving
- Chasing
- Founding
- Relief Sculpture
- Equestrian Statue
- Bronze
- Chryselephantine
- Goldsmith's Work
- Terra Cotta
- Ivory
- Metal Work
- Wood-carving
- Stucco

#### II. GREEK AND ROMAN SCULPTURE.

The sculpture of Oriental countries

is decorative in character, and therefore best considered in connection with their architecture, under the titles of the division Oriental Art, enumerated in Chapter 9, Section A. Among the Greeks, sculpture first attained the dignity of an independent art, and achieved the highest ideal perfection in the world's history. The study of the separate epochs of Greek sculpture should be based upon the articles ARCHÆOLOGY and GREEK ART. Its rude beginnings date from the seventh century B. C., and by the end of the archaic period (B. C. 480) the emancipation was well advanced. The Attic period (480-323), during which the chief art centre was at Athens, witnessed the highest development of Greek art. It is ushered in by a period of transition (till about 450), in which great progress was made towards mastery of technique. The last half of the fifth century, the age of Phidias, begins the golden period of Greek art. The greatest technical knowledge was subordinated to idealism and self-restraint, and to the utmost nobility of conception. The golden age continued during the epoch of Praxiteles and Scopas, which, though still ideal, was more realistic and interested in individual traits and features. It succeeded especially well in portraiture, and attained the highest mastery of technique. During the Hellenistic age (323-146), the centres of art passed from Greece to Asia and Egypt, to



Pergamus, Rhodes, and Alexandria. Art came more into the service of individuals, and, notwithstanding the highest technical skill, it often sought sensational or trivial subjects. Roman sculpture is, for the most part, copied from the Greek, and shows little originality except in a fine realistic rendition of portraiture, and in pictorial relief-sculpture. See:

1. *The Archaic Period:*

Archæology  
Greek Art  
Antenor

2. *The Attic Period:*

Æginetan Sculptures  
Calamis  
Pythagoras of Rhegium  
Myron  
Discobolus  
Phidias  
Elgin Marbles  
Polyclitus  
Agoracritus  
Cresilas  
Pæonius  
Cephisodotus  
Praxiteles  
Demetrius  
Scopas  
Mausoleum  
Marsyas

3. *The Hellenistic Period:*

Lysippus  
Pergamon  
Zeus Atricoli  
Apollo Belvidere  
Venus of Milo  
Laocoön

4. *The Roman Sculpture:*

Section Sculpture under Roman  
Art  
Venus of Medici

III. MÆDIEVAL SCULPTURE.

The decorative sculpture of the Middle Ages can best be studied in connection with the architecture of the period, under the titles of the mediæval epochs enumerated in Chapter 9, Section A. The history of modern sculpture begins with the Italian revival of the thirteenth century. Nicola Pisano found his models in the antique, but his son Giovanni reverted to the Gothic, and his naturalistic, dramatic style prevailed in Italy. The Pisan School was the mother of those of Florence and Siena. The former was superior in technique and composition, the latter was rather picturesque and narrative in character. During the entire Middle Ages, and to some extent during the Renaissance, the usages of Church worship furnished abundant opportunity for the sculptor's art. See:

1. *First Revival in Italy* (under Sculpture)

Christian Art  
Byzantine Art  
Romanesque Art  
Gothic Art  
Antelami, Benedetto  
Pisano, Nicola  
Pisano, Giovanni  
Pisano, Andrea  
Arnolfo di Cambio  
Andrea di Ugolino  
Orcagna, Andrea

2. *Ecclesiastical Sculpture:*

Altar  
Pulpit  
Ambo  
Cross  
Crucifix  
Reliquary

Chalice  
Tomb

## IV. THE RENAISSANCE.

The sources of inspiration during the Renaissance were the study of nature and of the antique, as it survived in ancient statues. The chief characteristic of the Early Renaissance is a healthy naturalism. It attained a high perfection, in relief as in statuary, and excelled equally in bronze, marble, and terra cotta. The centre of the art was Florence, and the dominant figure during the fifteenth century, amid a brilliant array of artists, was Donatello. The school of Siena was more sentimental in feeling and elaborate in decoration; those of Lombardy and Venice were luxuriant in decoration, the former being more vigorous in form. The High Renaissance is characterized by a deeper knowledge and greater influence of the antique and by a more universal style, notably in works of its greatest master, Michelangelo; but these qualities afterward degenerated into a mannered imitation, and later into the extravagances of the Baroque.

The sculpture of France in the fifteenth century was at first influenced by that of Flanders, but the native style soon became transformed by Italian grace and beauty. Even the Baroque of the seventeenth century here exhibits a certain classical restraint. During the eighteenth exaggerated form gave place to the more delicate and decorative treatment of the Rococo, which excelled especially in statuettes. A fine, healthy realism ultimately prevailed. In Germany, Gothic forms lingered throughout the

fifteenth century, and when, during the sixteenth, the Italian influence arrived, it was less important than in other countries and confined to the South. A native naturalistic art dominated the Netherlands during the fifteenth century, but, in the seventeenth, the Italian Baroque entered, and, in the eighteenth, sculpture declined. A similar development occurred in Spain, where wood sculpture found great employment in altars, retables, reredoses. Its apogee was a realistic reaction in the seventeenth century, with centre at Seville. See Section *The Renaissance*, under SCULPTURE.

1. *Italy*:

## (a) Florence:

Ghiberti, Lorenzo  
Donatello  
Michelozzi  
Robbia, Luca della  
Verrocchio, Andrea del  
Pollaiuolo, Antonio  
Desiderio da Settignano  
Rossellini  
Benedetto da Maiano  
Mino da Fiesole  
Civitate, Matteo  
Sansovino, Andrea  
Michelangelo  
Cellini, Benvenuto  
Boulogne, Jean

## (b) Other Cities:

Quercia, Jacopo della  
Mazzoni, Guido  
Solari, Cristoforo  
Lombardi, Pietro  
Leopardi, Alessandro  
Sansovino, Jacopo  
Leoni, Leone  
Bernini, Giovanni Lorenzo  
Algardi, Alessandro

*2. France:*

Colombe, Michel  
 Goujon, Jean  
 Pilon, Germain  
 Puget, Pierre  
 Coyzevox, Antoine  
 Girardon, François  
 Pajou, Augustin  
 Pigalle, Jean Baptiste  
 Falconnet, Etienne  
 Michel, Claude (Clodion)  
 Houdon, Jean Antoine

*3. Germany:*

Wohlgemuth, Michel  
 Stoss, Veit  
 Krafft, Adam  
 Vischer, Peter  
 Riemenschneider, Tilman  
 Syrlin, Jörz  
 Schlüter, Andreas  
 Donner, Raphael

*4. Other European Countries:*

Sluter, Claus  
 Duquesnoy, François  
 Quellinus, Artus  
 Berruguete, Alfonso  
 Montañes, Martinez  
 Cano, Alonzo  
 Gibbons, Grinling

## V. MODERN SCULPTURE.

The reaction upon the extravagances of Baroque sculpture, at the close of the eighteenth century, took the form of a return to classic simplicity, and the antique was imitated more closely than ever before. In France, this classicism was followed by a Romantic tendency, corresponding to a similar movement in painting, and by a more important naturalistic reaction. In the second half of the nineteenth

century, classicism and naturalism ran parallel, with an increasing influence of the latter, which now prevails. England had a similar classical period, and a subsequent transition to naturalism; but since 1870 a great change, both in conception and treatment, has come over English sculpture chiefly through the effort of great English painters and the French influence. The German reaction against classicism resulted in the historical school of Berlin, whose work tended toward naturalism, and in the romantic school of Munich; not until the end of the nineteenth century did naturalism prevail. In other European countries the development has been similar to that general evolution described above. After some ineffectual early attempts, America also had its classical school, with a number of important artists. Since the last quarter of the nineteenth century the tendency has been entirely naturalistic, and an array of talent has appeared which compares favorably with that of other countries. See:

*1. France:*

Pradier, James  
 David d'Angers  
 Rude, François  
 Barye, Antoine Louis  
 Chapu, Henri Michel  
 Dubois, Paul  
 Mercié, Antonin  
 Barrias, Ernest  
 Bartholdi, Frédéric  
 Carpeaux, Jean Baptiste  
 Frémiet, Emmanuel  
 Dalou, Jules  
 Rodin, Auguste  
 Bartholomé, Paul Albert

*2. England:*

Flaxman, John  
 Westmacott, Richard  
 Gibson, John  
 Stevens, Alfred  
 Foley, John Henry  
 Woolner, Thomas  
 Watts, George Frederick  
 Thornycroft, Hamo  
 Brock, Sir Thomas  
 Ford, Edward Onslow  
 Gilbert, Alfred  
 Frampton, Sir George  
 Epstein, Jacob

*3. Germany:*

Dannecker, Johann Heinrich  
 Schadow, Johann Gottfried  
 Rauch, Christian  
 Hähnel, Ernst  
 Rietschel, Ernst  
 Schilling, Johannes  
 Schwanthaler, Ludwig  
 Begas, Reinhold  
 Stuck, Franz  
 Klinger, Max  
 Zumbusch, Kaspar  
 Tilgner, Viktor  
 Strasser, Arthur  
 Tuillon, Louis

*4. Other European Countries:*

Canova, Antonio  
 Thorvaldsen, Bertel  
 Tenerani, Pietro  
 Marchesi, Pompeo  
 Dupré, Giovanni  
 Ximenes, Ettore  
 Sergel, Johan Tobias  
 Sinding, Stefan  
 Antokolski, Mark  
 Troubetzkoi, Prince Paul

*5. United States:**(a) Classicists:*

Greenough, Horatio  
 Powers, Hiram  
 Crawford, Thomas  
 Story, William Wetmore  
 Rogers, Randolph  
 Rogers, John  
 Rinehart, William Henry  
 Hosmer, Harriet

*(b) Early Naturalists:*

Palmer, Erastus Dow  
 Mills, Clark  
 Ball, Thomas  
 Brown, Henry Kirke  
 Ward, J. Q. A.  
 Keyser, Ephraim

*(c) Naturalism Under French Influence:*

Warner, Olin Levi  
 Saint Gaudens, Augustus  
 French, Daniel Chester  
 Macmonnies, Frederick  
 Bitter, Karl  
 Niehaus, Charles Henry  
 Partridge, William Ordway  
 Dallin, Cyrus Edwin  
 Proctor, A. Phimister  
 Kemeys, Edward  
 Bartlett, Paul  
 Barnard, George Grey  
 Borglum, Gutzon  
 Borglum, Solon H.  
 Platt, Bela Lyon  
 Gaffey, Charles  
 Calder, Alexander S.  
 Taft, Lorado  
 Tilden, Douglas  
 Aitkin, Robert I.  
 Vonnoh, Bessie Potter

## B. Painting

A series of special articles treats the technical side of painting, the different varieties, the painter's implements, and the qualities by which a picture should be judged. The history of the different schools is comprehensively described under PAINTING. This article should form the basis of the study of any given school; it should, however, be supplemented by the articles on separate schools and the biographies of the artists, of which only the principal are contained in the following lists.

### I. TECHNIQUE AND ALLIED ARTS.

#### 1. *Varieties:*

- Mural Decoration
- Genre Painting
- Portraiture
- Landscape
- Still Life

#### 2. *Technical Processes:*

- Fresco
- Tempera
- Oil Painting
- Pastel
- Water-Color Painting
- Encaustic Painting
- Stereochromy

#### 3. *Implements:*

- Canvas
- Easel
- Mahlstick
- Ground
- Painters' Colors

#### 4. *Technical Qualities:*

- Drawing
- Line
- Perspective
- Chiaroscuro

Color

Composition

Proportion

#### 5. *Analogous Arts:*

Mosaic

Stained Glass

Decorative Art

Sgraffito

### II. GREEK PAINTING.

The decorative painting of Oriental countries is treated under the different titles of the subdivision Oriental Art, in the introductory section of the preceding chapter. Greek painting was the first to rise to the dignity of an independent art. The transition from the painting of Cretan and Mycenaean decorations, which show considerable technical skill and a high power of invention, to that of the fifth century B. C. can be studied only in vase-painting (see VASE). In the fifth and fourth centuries B. C., Greek painting attained its highest development. The older Attic School, with Polygnotus as its founder and Athens as a centre, brought the art to a high state of development in the years following the Persian wars. Its decorative work was practically great, colored, outline drawings, noble in composition and expression. Perspective and shading were discovered by Agatharchus of Samos, a scene painter, and applied to panel-painting by Apollodorus of Athens. In the later fifth century flourished the Ionian School of Zeuxis and Parrhasius, which substituted realism for the old idealism and excelled in delicate drawing and chiaroscuro.

In the early fourth century, the centre of painting shifted to Sicily, where systematic drawing and chiaroscuro were further developed, and the process of encaustic painting was invented. The Theban-Attic School (second half of the fourth century) was devoted to impassioned subjects, like battle pieces, and even to genre, and the highest technical perfection was achieved by the younger Ionian School in the persons of Apelles and Protogenes. In the Hellenistic age painting increased the range of its expression, including even the landscape, but it declined in artistic quality. The decorative and less important painting of the Roman epoch is treated under **ROMAN ART**. See:

#### 1. *General References:*

Section *Painting* under Greek  
Art and Roman Art  
Vase

#### 2. *Greek Painters:*

Polygnotus  
Micon  
Agatharchus  
Apollodorus  
Zeuxis  
Parrhasius  
Pamphilus  
Pausias  
Apelles  
Protogenes  
Aldobrandini Marriage

### III. MEDIEVAL PERIOD.

The origins of Mediæval painting were conditioned by the Mosaic style, as it prevailed in Early Christian and Byzantine art. Its growth was dependent upon the development of architecture in Church worship, and it con-

sequently remained decorative. At the close of the Gothic period, the emancipation of painting began in Italy, and individual artists arose. The chief centres were Florence, where Giotto founded a powerful school of mural painting, and Siena, which developed panel painting under strong Byzantine influence. See:

Mosaic  
Christian Art  
Byzantine Art  
Romanesque Art  
Gothic Art  
Florentine School of Painting  
Sienese School of Painting  
Cavallini, Pietro  
Cimabue  
Giotto  
Gaddi, Taddeo  
Orcagna, Andrea  
Aretino, Spinello  
Duccio di Boninsegna  
Martini, Simone  
Lorenzetti  
Gentile da Fabriano  
Lorenzo, Don

### IV. THE RENAISSANCE.

Naturalism dominated the painting of the Early Renaissance in Italy, the classic influence appearing only in the decorative motifs. Our study begins with Florence, where the great technical problems were solved for future painting. The High Renaissance combined the achievements of the Early with a profounder knowledge of the Antique. The Florentine school ranked highest in everything but color, in which the Venetians excelled, as did the Umbrians in religious sentiment. In Northern Europe the Renaissance, entirely naturalistic in character, but

Gothic in sentiment, first appeared in Flanders, whence its influence extended to Holland and Germany. Later the Italian influence transformed for the worse the art of the Netherlands, but aided to produce a national school in Germany. See:

### 1. *Italy.*

#### (a) General Titles:

Renaissance Art

Section *The Renaissance* under Painting

Florentine School of Painting

Umbrian School of Painting

Bolognese School of Painting

Ferrarese School of Painting

Venetian School of Painting

#### (b) Biography:

##### (i) Florence:

Masolino da Panicale

Angelico, Fra

Masaccio

Uccello, Paolo

Castagno, Andrea del

Lippi, Filippo and Filippino

Botticelli, Sandro

Gozzoli, Benozzo

Pollaiuolo, Antonio

Verrocchio, Andrea

Ghirlandaio, Domenico

Vinci, Leonardo da

Michelangelo

Bartolommeo, Fra

Sarto, Andrea del

Bronzino, Agnolo

##### (ii) Umbria:

Francesca, Piero della

Melozzo da Forlì

Santi, Giovanni

Signorelli, Luca

Perugino, Pietro

Pinturicchio

Raphael

##### (iii) Northern Italy:

Squarcione, Francesco

Mantegna, Andrea

Tura, Cosimo

Costa, Lorenzo

Francia, Francesco

Viti, Timoteo

Dosso Dossi

Garofalo

Correggio

Sodoma

Pisanello

Foppa, Vincenzo

Borgognone

Predis, Ambrogio da

Solario, Andrea

Luini, Bernardino

Ferrari, Gaudenzio

##### (iv) Venice:

Vivarini

Crivelli, Carlo

Antonello da Messina

Bellini (family)

Carpaccio, Vittore

Giorgione

Titian

Bonifazio Veronese

Lotto, Lorenzo

Tintoretto

Veronese, Paolo

Bassano

Moretto da Brescia

Moroni, Giambattista

##### (v) Rome:

Sebastiano del Piombo

Volterra, Daniele da

Pippi, Giulio (called Romano)

### 2. *The Netherlands:*

Netherlands Schools of Painting

Eyck, Huybrecht and Jan van

Weyden, Rogier van der

Bouts, Dierick

Hugo van der Goes  
 Memling, Hans  
 David, Gerard  
 Matsys, Quinten  
 Orley, Bernaert van  
 Mabuse, Jan  
 Lucas van Leyden  
 Bosch, Hieronymus

### 3. *Germany:*

Lochner, Stephan  
 Schongauer, Martin  
 Wohlgemuth, Michel  
 Dürer, Albrecht  
 Burekmair, Hans  
 Cranach, Lucas  
 Holbein the Elder  
 Holbein the Younger  
 Grünewald, Matthias  
 Baldung, Hans

### 4. *France and Spain:*

Fouquet, Jehan  
 Clouet  
 Cousin, Jean  
 Coello, Alonzo  
 Morales  
 Theotocopuli (called El Greco)

## V. SEVENTEENTH AND EIGHTEENTH CENTURIES.

The seventeenth century saw the rise of the Eclectic and Naturalist schools in Italy, and of a courtly art, based upon the classic, in France, whose artists in Italy also perfected the classic landscape. It was the golden age of painting in Spain, Flanders and Holland. Spain developed a great religious art, combining Catholic devotion with a trenchant realism, and a marvelous portraitist in Velazquez. The Flemish School was also realistic, but more influenced by Italy, and less religious in character. In Holland, a

highly developed national realism, practically uninfluenced from without, found expression in panels of portrait, genre, landscape, animal, and still life. The eighteenth century witnessed in France the light, graceful and decorative painting of the Rococo, and the rise in England of a bourgeoisie art, showing a curious admixture of Eclectic Italian influence with realism, and foreshadowing that of the nineteenth century. See Section *Seventeenth and Eighteenth Centuries* in the article on PAINTING.

### 1. *Italy:*

Bolognese School of Painting  
 Carracci  
 Domenichino  
 Reni, Guido  
 Guercino  
 Dolci, Carlo  
 Caravaggio  
 Rosa, Salvator  
 Giordano, Luca  
 Tiepolo  
 Canaletto  
 Guardi, Francesco  
 Carriera, Rosalba

### 2. *France:*

Poussin, Nicolas  
 Gelée, Claude (Claude Lorrain)  
 Lebrun, Charles  
 Mignard, Pierre  
 Champagne, Philippe de  
 Watteau, Antoine  
 Fragonard, Jean Honoré  
 Chardin, Jean Siméon  
 Lancret, Nicolas  
 Boucher, François  
 La Tour, Maurice  
 Quentin  
 Greuze, Jean Baptiste  
 Vigée-Lebrun



3. *Spain*:

Herrera the Elder  
 Ribera, Jusepe  
 Velazquez  
 Zurbaran  
 Cano, Alonzo  
 Coello, Claudio  
 Murillo  
 Goya y Lucientes

4. *Flanders*:

Rubens, Peter Paul  
 Van Dyck, Anthonis  
 Jordaens, Jacob  
 Snyders, Frans  
 Fyt, Jan  
 Teniers the Younger  
 Brouwer, Adriaen

5. *Holland*:(a) *Portraiture* (q. v.):

Mierevelt, Michiel  
 Hals, Frans  
 Rembrandt  
 Maes, Nicolas  
 Helst, Bartholomeus van der

(b) *Genre* (q. v.):

Ostade, Adriaen van  
 Dou, Gerard  
 Steen, Jan  
 Terborch, Gerard  
 Metzu, Gabriel  
 Hooch, Pieter de  
 Vermeer van Delft

(c) *Landscape* (q. v.), etc.:

Goyen, Jan van  
 Ruysdael, Salomon  
 Neer, Aert van der  
 Ruisdael, Jacob  
 Hobbema, Meindert  
 Potter, Paulus  
 Velde, Adriaen van de  
 Cuyp, Albert  
 Backhuysen, Ludolf

Velde, Willem van de, the  
 Younger

Heem, Jan de  
 Huysum, Jan van  
 Beyeren, Abraham van  
 David, Gerard  
 Weenix, Jan  
 Hondecoeter, Melchior

6. *England*:

Lely, Sir Peter  
 Kneller, Sir Godfrey  
 Hogarth, William  
 Reynolds, Joshua  
 Gainsborough, Thomas  
 Romney, George  
 Wilson, Richard  
 Morland, George

## VI. MODERN PAINTING.

1. *France*.

During the nineteenth century the hegemony of Europe in the fine arts belonged to France. Rococo art was succeeded in the last part of the eighteenth century by Classicism, which found the chief beauty of painting in form, as revealed in ancient sculpture. The reaction upon Classicism was Romanticism (from c. 1830), which used painting as an expression of the artist's emotional nature, and placed the chief emphasis upon color and natural truth. The Barbizon School represents the emotional impulse of Romanticism, as applied to landscape, animal painting, and peasant subjects. The third great factor in French painting is Realism, advocating the abolition of academic law and sentiment, and the exact presentation of natural truth. Then came Impressionism (1874), so called from a tendency to render momentary impressions, but which sought,

above all, to paint evanescent effects of light. Post Impressionism is a reaction on both Impressionism and Realism, which endeavors to paint pure feeling in purely abstract form and color. See:

(a) Classicists:

David, Jacques Louis  
Prudhon, Pierre  
Gros, Antoine Jean  
Ingres, Jean Auguste Dominique

(b) Romanticists:

Géricault, Jean Louis  
Delacroix, Eugène  
Décamps, Alexandre Gabriel  
Fromentin, Eugène  
Vernet, Horace  
Couture, Thomas  
Regnault, Henri

(c) Eclectics:

Delaroche, Paul  
Bouguereau, Guillaume Adolphe  
Scheffer, Ary

(d) Barbizon Painters:

Corot, Camille  
Rousseau, Théodore  
Dupré, Jules  
Díaz de la Peña  
Daubigny, Charles François  
Millet, Jean François  
Troyon, Constant  
Jacques, Charles  
Cazin, Jean Charles

(e) Realists:

Courbet, Gustave  
Bonnat, Léon  
Duran, Carolus  
Fantin-Latour  
Meissonier, Ernest  
Neuville, Alphonse Marie de  
Détaille, Edouard

(f) Impressionists, etc.:

Impressionist Painting  
Manet, Edouard  
Renoir, August  
Degas, Hilaire Germain  
Raffaelli, Jean François  
Monet, Claude  
Pissaro, Camille  
Sisley, Alfred  
Besnard, Paul Albert

(g) Post Impressionists:

Post Impressionism  
Cézanne, Paul  
Gauguin, Paul  
Matisse, Henri  
Picasso, Pablo  
Picabia, Francis

(h) Various Tendencies:

Flandrin, Jean Hippolyte  
Puvis de Chavannes  
Moreau, Gustave  
Gérôme, Jean Léon  
Vollon, Antoine  
Bonheur, Rosa  
Bastien-Lepage  
Dagnan-Bouveret  
Lhermitte, Léon

2. *Germany (including Austria).*

In Germany the reaction against Classicism first took the form of an imitation of Italian masters of the fifteenth century (Nazarenes). Extensive demand for mural decoration at Munich produced the so-called cartoon (q. v.) style, in which color was neglected. The Düsseldorf School represented the romantic tendencies of German art, chiefly in panel-painting. About 1850 a great change was effected by French and Belgian colorists; since 1870 Realism and since 1880 Impressionism have found entrance. The

most recent tendencies have been very radical (see SECESSION) and decorative in character, especially in Vienna. See:

Pre-Raphaelites  
 Düsseldorf School of Painting  
 Mengs, Raphael  
 Kauffmann, Angelica  
 Overbeck, Johann Friedrich  
 Cornelius, Peter von  
 Kaulbach, Wilhelm von  
 Rethel, Alfred  
 Schwind, Moritz von  
 Feuerbach, Anselm  
 Makart, Hans  
 Max, Gabriel  
 Munkácsy, Michael  
 Knaus, Ludwig  
 Defregger, Franz von  
 Grützner, Eduard  
 Menzel, Adolf  
 Lenbach, Franz  
 Leibl, Wilhelm  
 Böcklin, Arnold  
 Liebermann, Max  
 Klinger, Max  
 Thoma, Hans  
 Uhde, Fritz von  
 Gebhard, Eduard  
 Kampf, Arthur  
 Zügel, Heinrich  
 Stuck, Franz

### 3. *Great Britain.*

The chief aim of British art during the early nineteenth century was historical pictures of an academic order. Landscape painting culminated in Turner and Constable. A reaction against the academic came about through the Pre-Raphaelites (q. v.), who introduced spiritual and realistic elements. The chief influence in recent years has been French. See:

Raeburn, Sir Henry  
 Lawrence, Sir Thomas  
 Hoppner, John  
 Haydon, Benjamin Robert  
 Eastlake, Sir Charles  
 Blake, William  
 Wilkie, David  
 Turner, J. M. W.  
 Crome, John  
 Constable, John  
 Rossetti, Dante Gabriel  
 Hunt, William Holman  
 Burne-Jones, Sir Edward  
 Millais, Sir John Everett  
 Watts, George Frederick  
 Herkomer, Hubert  
 Leighton, Frederick, Lord  
 Alma-Tadema, Lawrence  
 Orchardson, W. Q.  
 Lavery, John  
 Hornell, Edward  
 Shannon, James J.

### 4. *Other Countries.*

In other European countries the development through the Classical, Romantic, and Naturalistic stages was not dissimilar to those already described. All have profited by French technical methods, and are, to a greater or less extent, swayed by Realistic and Impressionistic tendencies. See:

#### (a) *Belgian and Dutch:*

Gallait, Louis  
 Leys, Baron Hendrik  
 Wiertz, Antoine Joseph  
 Stevens, Alfred  
 Lempoels, Jeff  
 Khnopff, Fernand  
 Israels, Josef  
 Mesdag, Hendrik  
 Mauve, Anton  
 Maris, The Brothers

Gogh, Vincent van  
Toorup, Jan

(b) Scandinavian and Russian:

Zorn, Anders  
Larsson, Carl  
Liljefors, Bruno  
Kroyer, Peter Severin  
Thaulow, Frits  
Vereshtchagin, Vassili  
Repin, Ilia Yefimovitch

(c) Spanish, etc.:

Fortuny, Mariano  
Sorolla, Joaquin  
Segantini, Giovanni

5. *United States.*

During the Colonial period and immediately after the Revolution, British influences prevailed in the United States, with an inclination to follow the Italians in larger subjects. An indigenous art began with the self-taught Hudson River School, about 1825. Then came the foreign influence, and, since 1875, French methods have been quite generally adopted, the natural characteristics revealing themselves in choice of subject and conceptions.

(a) Early Period:

West, Benjamin  
Copley, John Singleton  
Peale, Charles Wilson  
Trumbull, John  
Stuart, Gilbert  
Allston, Washington  
Peale, Rembrandt  
Sully, Thomas  
Jarves, John Wesley

(b) Middle Period:

Hudson River School of Painting  
Cole, Thomas  
Durand, Asher Brown

Kensett, John Frederick  
Church, Frederick Edwin  
Bierstadt, Albert  
Moran, Thomas  
Harding, Chester  
Neagle, John  
Inman, Henry  
Huntington, Daniel  
Fuller, George  
Ryder, Albert P.  
Johnson, Eastman  
Brown, John G.  
Mount, William Sidney  
Leutze, Emanuel  
Hicks, Thomas  
Hunt, William Morris  
Homer, Winslow  
Inness, George  
Wyant, A. H.  
Martin, Homer D.

(c) Third, or Cosmopolitan, Period:

(i) Figure and Portrait:

Whistler, James Abbott Mc-  
Neil  
Abbey, Edwin A.  
Sargent, John Singer  
Vedder, Elihu  
Duveneck, Frank  
Dielman, Frederick  
Chase, William Merrit  
Eaton, Wyatt  
Weir, James Alden  
Thayer, Abbott  
Brush, George De Forest  
Tarbell, Edmund  
Benson, Frank Weston  
Dewing, Thomas W.  
Blum, Robert F.  
Walker, Horatio  
Remington, Frederick  
Couse, E. Irving  
Wiles, Irving  
Alexander, John W.

Decamp, Joseph R.  
 Eakins, Thomas  
 Beaux, Cecilia  
 Harrison, (Thomas) Alexander  
 Melchers, Gari  
 Cassatt, Mary

(ii) Landscape:

Dewey, Charles Melville  
 Blakelock, Ralph  
 Dearth, Henry Golden  
 Wiggins, Carlton  
 Robinson, Theodore  
 Bunce, William Gedney  
 Murphy, John Francis  
 Crane, Bruce  
 Harrison, (Lovell) Birge  
 Twachtman, John Henry  
 Dougherty, Paul  
 Hassam, Childe  
 Foster, Ben  
 Schofield, W. Elmer  
 Redfield, Edward Willis  
 Symons, Gardner  
 Chapman, Carlton T.  
 Waugh, Frederick Judd  
 Carlsen, Emil

(iii) Mural Painting (q. v.):

La Farge, John

Cox, Kenyon  
 Blashfield, Edwin H.  
 Mowbray, Henry Siddons  
 Rogers, H. O.  
 Millet, Frank D.  
 Oakley, Violet

(iv) Recent Tendencies:

Henri, Robert  
 Bellows, George  
 Lie, Jonas  
 Lawson, Ernest  
 Mora, Luis  
 Hawthorne, Charles W.  
 Miller, Richard E.  
 Friesoecke, Frederick Carl  
 Dabo, Léon

VI. PASTEL, WATER-COLOR, AND MINIATURE PAINTING.

The basis of study should be the general articles on these three varieties of painting, which discuss their technique and history and enumerate the principal artists. The most important of the latter are treated as special titles, to which reference should be made.

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# Chapter 12. The Minor Arts

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## A. Engraving

Engraving is the art of producing on a hard surface, such as stone, metal, or wood, incised or relief designs. These may be for purposes of decoration, as in the case of engraved bronzes and silverware, or for stamping a soft substance, as seal rings. But engravings are usually made for the purpose of printing upon paper, and it is this variety with which we are chiefly concerned.

Printing is done either from incised designs to which the ink is applied, or from relief designs, which thus produce the image. In the first process, metal plates, usually of copper, are used; the principal varieties are Line-Engraving and Etching, to which may be added Dry Point, *Manière Criblée*, and Stipple. The chief form of Engraving in relief is Wood-Engraving; and there are mixed processes, like Aquatint, Mezzotint, and Soft-Ground Etching. The trial impressions upon paper are called the proofs, and the final result the print. The article ENGRAVING contains a general sketch of the subject. See also:

Line Engraving

Etching

Dry Point

*Manière Criblée*

Stipple

Wood Engraving

Aquatint

Mezzotint

Soft-Ground Etching

Print Proof

### I. LINE ENGRAVING.

Line Engraving is done with the burin, usually upon a copper plate. It

originated simultaneously in Italy and Germany during the early fifteenth century, probably with the goldsmiths, from the custom of printing trial impressions of niello plates. (See NIELLO.) The earliest line-engravings are mere outline drawings without light or shade. In the early sixteenth century, the art culminated in the works of Albrecht Dürer in Germany, Lucas van Leyden in Holland, and Marcantonio Raimondi in Italy. During the seventeenth century, especially under Louis XIV, France was predominant. But artists devoted themselves increasingly to the reproduction of great paintings instead of original designs. For this reason, the art has gradually sunk into disuse, its place being taken by photographic processes. See:

Line-Engraving (basis of study)

Burin

Niello

### 1. *Italy*:

Finiguerra, Tomaso

Jacopo dei Barbari

Mantegna, Andrea

Raimondi, Marcantonio

Carracci, Agostino

Piranesi, Giambattista

Morghen, Raffaello

### 2. *Germany; Netherlands*:

Schongauer, Martin

Dürer, Albrecht

Lucas van Leyden

Beham, Hans Sebald

Beham, Barthel

Vorsterman, Lucas

Chodowiecki, Daniel

3. *England:*

Strange, Sir Robert  
Vertue, George

4. *France:*

Bosse, Abraham  
Nanteuil, Robert  
Masson, Antoine  
Audran, Gérard  
Cochin, Charles Nicolas  
Forster, François  
Henriquel-Dupont, Louis Pierre  
Gaillard, Claude Ferdinand

## II. ETCHING.

In etching, the plate is covered with the ground, usually a varnish, into which the design is scratched with an etching-needle. The plate is then immersed in an acid, which eats the design into the metal. The finishing touches are often done by the dry-point process, a simple scratching of the plate without the use of ground or acid.

Etching upon steel armor, etc., was practiced in the Middle Ages. Dürer was one of the first to use etching for printing purposes, and the art reached its highest development in Holland during the seventeenth century. Many eminent painters practiced it, among whom was the greatest etcher of all times, Rembrandt. Next to Holland, etching was principally cultivated in France, beginning with Claude Lorrain's landscapes. The art found a revival in the nineteenth century, especially in France, but also in England, Germany, and the United States. The following list cites only the principal etchers and a few of the important painters who have practiced etching. See *Etching* (basis of study):

1. *Netherlands:*

Lucas van Leyden  
Velde, Esaias van de  
Rembrandt  
Ruisdael, Jacob  
Potter, Paul  
Van Dyck, Anthonis

2. *France:*

Gelée, Claude (Claude Lorrain)  
Flameng, Leopold  
Rajon, Paul  
Méryon, Charles  
Jacquemart, Jules Ferdinand  
Legros, Alphonse  
Helleu, Paul

3. *Germany:*

Hollar, Wenzeslas  
Unger, William  
Klinger, Max  
Thoma, Hans  
Liebermann, Max

4. *Spain:*

Goya, Francisco

5. *England:*

Geddes, Andrew  
Wilkie, Sir David  
Turner, J. M. W.  
Hamerton, Philip Gilbert  
Haden, Francis Seymour  
Menpes, Mortimer  
Brangwyn, Frank

6. *United States:*

Whistler, James Abbott McNeil  
Pennell, Joseph  
Moran  
Parish, Stephen  
Platt, Charles A.  
Webster, Herman A.

## III. WOOD ENGRAVING.

In early Wood Engraving, the design, and the early wood engraving at-

block, and all the wood was cut away except the design, which remains in relief. The process is of peculiar importance because it can be used in connection with printing from movable types.

Crude outline prints from wood-cuts were common in Southern Germany and the Netherlands in the early fifteenth century. The art received an impetus from the invention of printing, and the early wood engraving attained its most perfect development during the early sixteenth century in the works of Albrecht Dürer and Hans Holbein in Germany. It was introduced by German artists into Italy; but here only the chiaroscuro process attained a high degree of proficiency. (See paragraph *Chiaroscuro* under WOOD ENGRAVING.) Wood engraving flourished also in the Netherlands and in France.

Modern wood engraving is done on the cross-grain of boxwood, and with a graver instead of the knife. The design is cut away instead of being left in relief, appearing in white lines. The father of the art was the Englishman, Thomas Bewick (died in 1828), although his pupils achieved much as book illustrators. The art has, during late years, succumbed in England to the more accurate photographic processes. Present German wood engraving is, generally speaking, precise and careful in execution; but the French school has attained the highest artistic perfection.

Before the Civil War, America produced several prominent wood engravers whose work resembled contemporary British. But after 1870, in connection with the popular magazines, a

school, headed by Timothy Cole, arose which reproduced the effect of paintings, drawings, etc., with remarkable fidelity, and used the technical proficiency acquired to render portraits and landscapes. Since the perfection of the photographic processes, wood engravers have returned to a more legitimate practice of their art wood engraving. See:

1. *Germany:*

Dürer, Albrecht  
Burckmair, Hans  
Schäuffelein, Hans  
Holbein the Younger  
Lützelburger, Hans  
Cranach, Lucas  
Altdorfer, Albrecht  
Beham, Hans Sebald  
Aldegrevier, Heinrich  
Baldung, Hans  
Menzel, Adolf  
Richter, Ludwig

2. *France:*

Cousin, Jean  
Charpentier, François  
Bracquemond, Joseph Auguste  
Johannot, Tony  
Grandville  
Gavarni  
Doré, Gustave

3. *Italy:*

Carpi, Ugo da  
Andreani, Andrea

4. *England:*

Bewick, Thomas  
Blake, William  
Linton, William James

5. *United States:*

Anderson, Alexander  
Smillie, James D.



Danforth, Moseley Isaac  
 Cole, Timothy  
 Juengling, Frederick  
 Kruell, Gustav  
 Wolf, Henry

#### IV. LITHOGRAPHY.

In lithographic processes, the design is drawn with crayon or fatty ink upon a porous stone or metal, possessing the property of retaining fatty substances and water to the evaporating point. The remainder of the stone is moistened with water. A roller covered with fatty printing ink will retain only the design, being repelled by the moist portions. Lithography was invented in 1798, by Aloys Senefelder, at Munich. Since the invention of the power press, it has become a world-wide industry. See:

Lithography  
 Senefelder, Aloys  
 Whistler, James Abbott McNeil  
 Pennell, Joseph

The principal artists cited under LITHOGRAPHY.

#### V. PHOTO-ENGRAVING.

This is a mechanical process in which the plates are prepared from a photographic negative by means of the action of light upon gelatine and other substances. It may be intaglio, in which the French name photogravure is used, or relief. The finishing touches are done by hand. The half-tone process, now generally used for purposes of illustration, is done on plates of ruled lines of extreme fineness. See PHOTO-ENGRAVING.

#### VI. ILLUSTRATION.

The article ILLUSTRATION treats the decoration and illustration of books,

and its history from the Egyptian papyri to the modern newspaper. This should be supplemented by ILLUMINATED MANUSCRIPTS, treating especially the Middle Ages and Renaissance. With the invention of printing, wood engraving (q. v.) became the principal means of illustration. Since 1850 photo-engravings have been increasingly used, and, in recent years, colored illustrations, some of great beauty, have been produced, especially in the leading magazines. The article CARICATURE describes in detail the important influence of that factor of illustration. The principal illustrators are enumerated there, under WOOD-ENGRAVING, and in the list subjoined.

##### 1. *France:*

Callot, Jacques  
 Daumier, Honoré  
 Gavarni  
 Cham  
 Caran d'Ache  
 Forain, Jean Louis  
 Willette, Léon Adolphe

##### 2. *England:*

Gilray, James  
 Cruikshank, George  
 Doyle, John  
 Leech, John  
 May, Phil  
 Du Maurier, George  
 Tenniel, Sir John  
 Crane, Walter  
 Beardsley, Aubrey Vincent

##### 3. *United States:*

Nast, Thomas  
 Gibson, Charles Dana  
 Christy, Howard Chanler  
 Fisher, Harrison  
 Flagg, James Montgomery

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## Chapter 13. Music

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**T**O appreciate music requires chiefly a receptive temperament. Obviously, the more one understands of the technique whereby certain harmonious results are produced, the greater will be the enjoyment of those results. But, irrespective of the critical interest in music, its first appeal must be, and is, to the imagination and the emotions. The layman in the audience is not thrilled by the cold, technical fact that the violinist, yonder on the stage, is producing that wonderfully soft, birdlike note by the infinitesimal, *even* pressure of his little finger on the highest possible note of the A string. The musicians, the violinists, the critics, realize the years of study that have contributed to the production of that perfect note, and their admiration is greater, but their enjoyment of the emotional result is no more keen, than that of the musical proselyte beside them.

This theory, which is based on actualities, finds its logical expression in the system that has been adopted in outlining the department of Music in the *New International Encyclopædia*. There is, first, a synopsis of the articles which would interest the general reader by giving an historical and appreciative résumé of music as an art. The second subdivision is more especially for the student, or for the reader who desires to master the technique and science of music, in order that he may "see with an understanding eye" and hear with a critical nicety of discrimination.

### 1. INTRODUCTORY.

Music  
Music, History of  
Sacred Music  
Opera (with the accompanying  
lists of operas)  
Oratorio (with the accompany-  
ing list of oratorios)  
Instrumental Music  
Musical Instruments (with cross  
references to individual arti-  
cles or instruments, under  
their own names)  
Orchestra  
Score  
Band  
Band, Military  
Organ  
Pianoforte  
Violin  
Singing

Dancing (with cross references  
to separate articles)

### 2. HISTORICAL.

Folk-Music  
Egyptian Music  
Hindu Music  
Chinese Music  
Japanese Music  
Hebrew Music  
Greek Music  
Magyar Music  
Arabian Music  
Scandinavian Music  
Slavonic Music  
Spanish Music  
Janizary Music  
Celtic Music  
Finnish Music  
Scotch Music  
Indian Music  
Negro Melodies

Minnesinger  
 Troubadours  
 Trouvère  
 Waits  
 Ambrosian Chant  
 Gregorian Chant  
 Hymnology  
 National Hymns

### 3. MUSICAL ORGANIZATIONS, ETC.

Guilds, Musical (under Guild)  
 Conservatory  
 Conductor  
 Precentor  
 Musical Festival  
 Gesellschaft der Musikfreunde  
 Gewandhaus-Concerte  
 Leeds Musical Festival  
 Choral Societies  
 Handel and Haydn Society  
 Oratorio Society  
 Singakademie  
 Philharmonic Societies  
 Boston Symphony Orchestra  
 Société des Concerts du Conservatoire  
 Sons of the Clergy Musical Festival  
 Chicago Symphony Orchestra  
 Cincinnati Symphony Orchestra  
 Minneapolis Symphony Orchestra  
 Three Choirs Festival  
 Bethlehem, Musical or Bach Festival  
 Worcester Musical Festival  
 Peterboro Musical Festival  
 Bayreuth Musical Festival

### 4. THE ART-FORMS.

Canon  
 Cantata  
 Catch  
 Chaconne

Chamber Music  
 Chant  
 Chorale  
 Concerto  
 Cyclical Forms  
 Duet  
 Étude  
 Fantasia  
 Form  
 Fugue  
 Glee  
 Humoreske  
 Imitation  
 Incidental Music  
 Interlude  
 Intermezzo  
 Introduction  
 Legend  
 Leitmotiv  
 Lied  
 Musical Drama  
 Nocturne  
 Offertory  
 Overture  
 Paraphrase  
 Passion  
 Pasticcio  
 Postlude  
 Pot-pourri  
 Prelude  
 Programme Music  
 Quartet  
 Recitative  
 Requiem  
 Rhapsody  
 Rondo  
 Scherzo  
 Serenade  
 Singspiel  
 Solo  
 Sonata  
 Song  
 Suite  
 Symphonic Poem

Symphony  
Trio  
Variation

Virginal  
Transposing Instruments  
Valves in Musical Instruments  
(under Valve)

5. DEFINITIONS AND DESCRIPTIONS OF  
TERMS AND PROCESSES USED IN  
THE INTERPRETATION OF MUSIC.

Musical Dictation

Beat

Baton

Rest

Tempo

Temperament

Rhythm

Syncopation

Expression

Musical Notation

Modulation

Intonation

Fingering

Position

Touch

Phrasing

Slide

Swell

Register

Augmentation

Movement

Passing Notes

Tremolo

Trill

Treble

Bass

Neumes

Value

Clang Tint, Explanation of

Finger-board

Clavichord

Janko Keyboard

Harpsichord

Manual

Metronome

Pedal

String

Voice

See also PIANO, ORGAN, SINGING,  
and MUSICAL INSTRUMENTS.

6. MISCELLANEOUS AND TECHNICAL  
ARTICLES.

The reader who has followed the course outlined in the earlier subdivisions, will find that the following articles are mainly specialized statements of general principles with which he is already familiar:

HARMONY:

Antiphony

Bar

Cadence

Cantus Firmus

Chord

Chromatic

Clef

Coda

Consonance

Degree

Diatonic Scale

Diazeutic Tone

Discord

Dissonance

Dominant

Figured Bass

Finale

Flat

Fundamental Note

Grace-notes

Guidonian Hand

Harmonics

Homophony

Improvisation

Instrumentation

Interval

Invention  
 Inversion  
 Key  
 Leading Tone  
 Leading of Voices  
 Leger-Lines  
 Major  
 Measure  
 Mediant  
 Melody  
 Meloplaste  
 Melos  
 Mensurable Music  
 Metre  
 Minor  
 Mixed Cadence  
 Modes  
 Monody  
 Motion  
 Motive  
 Natural  
 Nuances  
 Numerical Notation  
 Octave  
 Organ-Point  
 Organum  
 Part  
 Part-music  
 Passage  
 Passing Notes  
 Pitch  
 Plain Chant  
 Polyphony  
 Preparation  
 Principal  
 Progression  
 Reed  
 Relationship  
 Scale  
 Semitone  
 Sequence  
 Sharp  
 Solmization  
 Subdominant

Suspension  
 Tablature  
 Theme  
 Tierce  
 Tonality  
 Tone  
 Tonic  
 Tonic Sol-fa  
 Touch  
 Transcription  
 Transposition  
 Triad  
 Triplet  
 Typical Phrase  
 Unison  
 Variation

#### BIOGRAPHY.

A selected list of the world's great composers would include the following names:

Adam, A. C.  
 Agricola, M.  
 d'Albert, E.  
 Allegri, G.  
 Anerio, F.  
 Animuccia, G.  
 Arcadelt, J.  
 Arne, T. A.  
 Auber, D. F. E.  
 Bach, J. S.  
 Bach, K. P.  
 Balfe, M. W.  
 Barnby, J.  
 Beethoven, L.  
 Bellini, V.  
 Benedict, J.  
 Bennett, W. S.  
 Berlioz, H.  
 Bizet, G.  
 Boieldieu, F. A.  
 Bononcini, G. B.  
 Brahms, J.  
 Bruneau, A.

- Bull, J.  
Buxtehude, D.  
Caccini, G.  
Cambert, R.  
Carissimi, G.  
Cavalieri, E.  
Cherubini, M. L.  
Chopin, F. F.  
Cimarosa, D.  
Clementi, M.  
Corelli, A.  
Cornelius, P.  
Couperin, F.  
Cui, C.  
David, F. C.  
Debussy, C.  
Deprès, J.  
Donizetti, G.  
Durante, F.  
Dvorák, A.  
Elgar, E.  
Enna, A.  
Festa, C.  
Field, J.  
Flotow, F.  
Franck, C.  
Franz, R.  
Frescobaldi, G.  
Froberger, J. J.  
Gabrieli, A.  
Gabrieli, G.  
Gade, N. W.  
Gibbons, O.  
Giordano, U.  
Glinka, M. I.  
Gluck, C. W.  
Goldmark, K.  
Gossec, F. J.  
Goudimel, C.  
Gounod, C. F.  
Graun, K. H.  
Grétry, A. E. M.  
Grieg, E.  
Halévy, J. F.  
Handel, G. F.  
Haydn, J.  
Hérold, L. J. F.  
Hiller, J. A.  
Hofhaimer, P.  
Humfrey, P.  
Hummel, J. N.  
Humperdinck, E.  
d'Indy, V.  
Ippolitov-Ivanov, M.  
Isaak, H.  
Isouard, N.  
Jommelli, N.  
Keiser, R.  
Kiel, F.  
Lalo, E.  
Lasso, Orlando di  
Leo, L.  
Leonecavallo, R.  
Le Sueur, J. F.  
Liszt, F.  
Logroscino, N.  
Lortzing, G. A.  
Lotti, A.  
Lully, J. B.  
MacDowell, E. A.  
Mahler, G.  
Marschner, H.  
Mascagni, P.  
Massenet, J. E. F.  
Mendelssohn-Bartholdy, F.  
Meyerbeer, G.  
Monteverde, C.  
Morley, T.  
Mozart, W. A.  
Mussorgsky, M.  
Nanini, G. M.  
Offenbach, J.  
Okeghem  
Pachelbel, J.  
Paisiello, G.  
Palestrina, G. P.  
Pergolese, G. B.  
Piccini, N.

Ponchielli, A.  
Porpora, N. A.  
Prätorius, M.  
Puccini, G.  
Purcell, H.  
Raff, J.  
Rameau, J. P.  
Reger, M.  
Rimski-Korsakov, N.  
Rossini, G. A.  
Rubinstein, A.  
Sacchini, A. M.  
Saint-Saëns, C. C.  
Scarlatti, A.  
Schubert, F.  
Schumann, R.  
Schütz, H.  
Sibelius, J.  
Sinding, C.  
Smetana, F.  
Spohr, L.  
Spontini, G. L.  
Strauss, J.  
Strauss, R.  
Sullivan, A. S.  
Suppé, F.  
Tchaikovsky, P. I.  
Thomas, A.

Tartini, G.  
Verdi, G.  
Viotti, G. B.  
Volkmann, R.  
Wagner, R.  
Wallace, W. V.  
Weber, K. M.  
Willaert, A.  
Wolf, H.  
Zingarelli, N. A.

NOTE—The names of famous operas, oratorios, symphonies, dances, and national hymns have been omitted from the above classification. In the majority of cases, they will be found under their own proper titles, although brief mention of them would also be found in the general articles OPERA, ORATORIO, SYMPHONY, and NATIONAL HYMNS. The same is true of the scores of musical instruments and musical directions whose names will be found under the general articles ABBREVIATIONS, MUSICAL INSTRUMENTS and TEMPO.

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# Chapter 14. Mathematics

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**R**OUGHLY defined, mathematics is the science of forms and number. A few of the definitions given by eminent mathematicians are found in the general article MATHEMATICS, which is, therefore, a suitable introduction to the subject. The article gives a condensed history of mathematics, from earliest times to the present, together with a logical classification of the various branches of mathematics.

Mathematical science naturally falls into two main subdivisions: Pure Mathematics and Applied Mathematics. With this division as a basis, various classifications have been attempted. The best classification for the purpose of systematic reading is the one usually followed in the school curriculum, or in the text-books. In accordance with this, we may subdivide Elementary Mathematics into the following branches:

Arithmetic

Algebra

Geometry

Trigonometry

Analytic Geometry

Calculus

Division

Arithmetic Signs

Fraction

Involution and Evolution

Proportion

Checking in Arithmetic

Calculating Machines

Slide Rule

1. ARITHMETIC involves three phases: The conception of number, the representation of number by symbols, and the principles and methods of computation. A general discussion of these phases, together with their history, is given in the article ARITHMETIC, which, therefore, should be read as an introduction to this branch.

A more modern phase of arithmetic is computation by calculating machines. This process has already to a large extent replaced computations by hand, and seems to be destined to do so even more in the future.

The general articles bearing on this branch may be conveniently read in the following order:

(a) *Principles and Methods of Computation:*

Addition

Subtraction

Multiplication

(b) *Symbols, Representation, and Scales:*

Symbols

Numerals

Decimal System

Scales of Notation

(c) *Theory of Numbers:*

Number

Irrational Number

Complex Number

The detailed history of these topics is given separately in each article.

2. ALGEBRA is universal arithmetic, and has many features in common with arithmetic. The fundamental operations are the same, with the exception that algebra takes up the more general cases. The limitations of algebra are brought out in the general article ALGEBRA, where also a history of this branch is given. Since algebra and



arithmetic are so closely related, the fundamental operations are best treated together, and so the general articles bearing on the fundamental operations in algebra have been given under arithmetic. Those belonging almost exclusively to algebra are best taken up in the following order:

Coefficient  
Factor  
Exponent  
Associative Law  
Polynomial  
Negative Quantity  
Binomial  
Binomial Coefficients  
Binomial Theorem  
Remainder Theorem  
Equation  
Elimination  
Substitution  
Diophantine Analysis  
Series  
False Position, Rule of  
Cubic Equation  
Biquadratic Equations  
Permutations and Combinations  
Probability  
Determinants  
Logarithms  
Analysis

3. **GEOMETRY** is the science of form, and geometric concepts arise from the consideration of forms of objects just as numerical concepts arise from considering a collection of objects. Geometry is independent of algebra, and may be studied before or after algebra, but preferably after. The physical scientist considers only the space we live in, while the mathematician considers all possible spaces. Accordingly, we have many different kinds of geometry. A general classification and dis-

cussion of the several geometries is given in the article **GEOMETRY**. Although algebra and geometry are independent, a correspondence may be set up between them. This is brought out in the article **CORRESPONDENCE**. The general articles are best read in the following order:

Euclid  
Axiom  
Theorem  
Problem  
Corollary  
Angle  
Arithmetic and Geometric Signs  
Equiangular  
Equilateral  
Congruence  
Duality  
Construction  
Locus  
Triangle  
Circle  
Quadrilateral  
Polygon  
Circumscribed and Inscribed Figures  
Contact  
Perimeter  
Transversal  
Antiparallels  
Concurrence and Collinearity  
Maxima and Minima  
Similarity  
Symmetry  
Plane  
Octahedron  
Polyhedron  
Projective Geometry  
Projection  
Homology  
Perspective  
Isoperimetric Figures  
Engineering Instruments  
Surveying

Planimeter  
 Mensuration  
 Protractor  
 Vernier  
 Quadrature  
 Weights and Measures  
 Duplication of Cube (under Cube)  
 Quadrature of Circle (under Quadrature)  
 Trisection of an Angle

4. **TRIGONOMETRY** in elementary mathematics deals with the study of triangles, and the measurement of their sides, angles, and areas. This is, however, only a part of the general subject. Under the article **TRIGONOMETRY**, almost a whole text-book treatment is given, together with a short history of the subject from earliest times. As an introduction, read the article **LOGARITHMS**. An elementary knowledge of algebra and geometry is, however, necessary before the study of trigonometry can be taken up.

5. **ANALYTIC GEOMETRY** is the application of algebra to geometry, and the combination of the two is the most powerful tool of the modern mathematician. More general results may be deduced, and better classification effected, by means of analysis. In the general article **ANALYTIC GEOMETRY**, the aim and general method of procedure is given, together with a short history of the subject. The other articles may be conveniently read in the following order:

Coördinates  
 Graphic Method  
 Curve  
 Analysis  
 Cartesians  
 Parameter  
 Locus

Contact  
 Normal  
 Tangent  
 Conic Sections  
 Circle  
 Pole and Polar  
 Parabola  
 Ellipse  
 Hyperbola  
 Surface  
 Cone  
 Conoid  
 Spheroid  
 Generation

*Higher Plane Curves:*

In these, are included all transcendental and all algebraic curves above the second order. As an introduction, read the article **CURVE**. Some of the most important articles are:

Cardioid  
 Catenary  
 Cissoid  
 Conchoid  
 Curve of Sines  
 Cycloid  
 Logarithmic Curve  
 Spiral  
 Lemniscate  
 Loxodrome  
 Witch

6. **CALCULUS**. This term usually refers to Differential and Integral Calculus. Differential Calculus deals with the relation between indefinitely small quantities or infinitesimals, and is of great service when the quantities under consideration are constantly changing. The problem of Integral Calculus is the inverse of that of Differential Calculus. Integral Calculus also deals with the application of calculus to mechanics and geometry.

In the general article **CALCULUS**, the methods and applications of calculus are illustrated by the solution of practical problems. As a historical introduction, read:

Indivisibles (under Cavalieri)

Fluxions

The general article **CALCULUS**, should also be preceded by:

Analysis

Limits, Theory of

Infinity and the Infinitesimal

and followed by:

Maclaurin's Theorem (under Maclaurin)

Curve

Osculation

Quadrature

Differential Equations (under Equation)

7. **HIGHER MATHEMATICS** is a collective term for all branches of mathematics that follow calculus. Most of these branches are based on calculus, but some, like the theory of numbers and group theory, are independent of calculus. The following articles will furnish an introduction to some of the branches of higher mathematics:

Forms

Functions

Modern Geometry (under Geometry)

Non-Euclidean Geometry (under Geometry)

Quaternions

Substitution

Theory of Numbers (under Number)

8. **APPLIED MATHEMATICS** deals with the application of mathematics to related sciences, like Mechanics, Astronomy, Physics, etc. See these departments in this work.

9. **BIOGRAPHY.** Mathematical knowledge dates back to the Egyptian and Babylonian civilizations, but the real development begins in Greece. This was chiefly in the realms of geometry. Later it inclined toward arithmetic. The Romans did nothing for mathematics, and the Arabs very little more than to translate and preserve the Greek learning. Through them it was introduced into the cloisters in Europe during the Middle Ages. The modern period in the history of mathematics begins with Descartes's invention of analytic geometry. The following is a list of the most eminent mathematicians, arranged according to their nationality or period:

(a) *Greek:*

Thales

Pythagoras

Aristotle

Plato

Euclid

Archimedes

Diocles

Nicomedes

Hippias of Elis

Menelaus

Apollonius of Perga

Hero of Alexandria

Ptolemy

Diophantus

Pappus

(b) *Arab:*

Al-Khuwarizmi

Al-Battani

(c) *Hindu:*

Aryabhatta

Brahmagupta

Bhaskara  
Mahavir

(d) *Persian:*

Omar Khayyam

(e) *From the revival of Mathematics  
in Europe to the middle of the  
17th century:*

Gerbert[under Sylvester(Pope)]  
Fibonacci  
Jordanus  
Peurbach  
Regiomontanus  
Paccoli  
Tartaglia  
Cardan  
Viète  
Napier  
Descartes

(f) *From the middle of the 17th cen-  
tury to the present time:*

Desargues  
Cavalieri  
Pascal  
Boscovich  
Fermat  
Wallis  
Barrow, I.  
Leibnitz  
Newton  
Bernoulli, Jakob  
Bernoulli, Johann

Bernoulli, Niclaus  
Bernoulli, Daniel  
Maclaurin  
Taylor  
Euler  
D'Alembert  
Monge  
Laplace  
Lagrange  
Legendre  
Fourier  
Gauss  
Poisson  
Poncelet  
Chasles  
Steiner  
Cauchy  
Möbius  
Lobachevsky  
Bolyai  
Abel  
Dirichlet  
Hamilton  
Jacobi  
Plücker  
Grassmann  
Galois  
Cayley  
Eisenstein  
Weierstrass  
Riemann  
Smith, H. J. S.  
Sylvester  
Clebsch  
Lie, Sophus  
Reye

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# Chapter 15. Astronomy

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**A**STRONOMY is the science which treats of the heavenly bodies—the sun and moon, the planets and their satellites, comets and meteors, the stars and nebulae. Astronomy is usually divided into many branches; these branches, however, are not distinct and separate, but overlap in all directions, so that no convenience as regards treatment is gained. The arrangement of the articles in the following lists is not according to branches, but in accordance with the order in which they may be conveniently read.

A general history of the progress of astronomical discovery is given in the general article ASTRONOMY, which, therefore, forms a suitable introduction to the subject. For a knowledge of a few of the elementary terms used in astronomy, see:

Zenith  
Horizon  
Equator  
Ecliptic  
Pole  
Azimuth  
Altitude  
Declination  
Latitude and Longitude  
Parallels  
Meridian  
Diurnal Motion  
Culmination

Chronometer  
Spectroscope

(b) *Corrections to Astronomical Observations:*

Depression  
Parallax  
Refraction  
Twilight  
Aberration

(c) *Time:*

The determination of time is one of the most important problems in astronomy, and is effected by observing the time of transit across the meridian of some celestial object. For the determination of time, read:

Transit Instrument  
Sextant  
Chronometer  
Ephemeris  
Equation of Time

## 1. ASTRONOMICAL OBSERVATIONS.

Astronomical observations are principally of two kinds: To determine distance, linear and angular; and to study the physical conditions of the heavenly bodies.

(a) *Instruments:*

Telescope  
Sextant  
Transit Instrument  
Meridian Circle  
Equatorial  
Zenith Telescope  
Micrometer  
Chronograph

Various ways of reckoning time have been used in history. Some of the principal ways used by the ancients, and also those used at present, are given in the following articles:

Period  
Chronology

Calendar  
 Hour  
 Week  
 Day  
 Month  
 Year  
 International Date Line  
 Prime Meridian Conference  
 Time Signals  
 Time, Standard

Eros  
 Moon  
 Gravitation  
 Parallax  
 Lunar Theory  
 Nutation  
 Perturbations  
 Precession  
 Tides  
 Latitude, Variation of  
 Seasons  
 Orbit  
 Elements  
 Eclipse

## 2. THE SOLAR SYSTEM.

The solar system consists of the sun as a central body, around which revolve the planets with their satellites, some periodic comets, and meteoric swarms. In addition to these permanent members, the system is occasionally visited by other comets, which move in parabolic orbits. As a historical introduction, read:

Ptolemaic System  
 Copernican System

Of the members of the solar system, the planetary system is of most immediate interest to us, since our earth is a member of this system. The sun and the planets, with their satellites and their interrelations, are treated in the following articles:

Sun  
 Planets  
 Solar System  
 Planetoids  
 Satellites  
 Vulcan  
 Mercury  
 Venus  
 Earth  
 Mars  
 Jupiter  
 Saturn  
 Uranus  
 Neptune

COMETS are usually very small in mass, though this has great extent. They move in very eccentric orbits about the sun, and the planes of their orbits present a great variety. The constituent parts and physical characteristics, the mass, the spectra, the number, discoveries, the capture theory, and origin of comets are treated in the article COMET.

METEORS are masses of stone or iron, which sometimes are seen to fall to the earth from the sky. The circumstances of the fall, the meteoric showers, the probable cause, the matter, path, and number of meteors are treated in the articles:

Meteors  
 Aërolite

## 3. THE STARS.

These bodies are usually called fixed stars, owing to the idea of the ancients that they were without motion. The fixity is, however, now disproved, and observations with the spectroscope show that they are moving with velocities comparable to those of bodies belonging to the solar system. Owing to

their immense distance, they appear, however, to keep their relative positions and configurations unchanged. This is only apparent, and there are stars whose displacement amounts to as much as 1" a year. In magnitude and physical condition, the stars are comparable with our sun, and many of them greatly exceed our sun in brightness and magnitude. The designation, magnitude, nature, and number of stars, the constellations, stellar parallax, proper motion, spectra, photometry, variable stars, double and multiple stars, binary stars, etc., are treated in the following articles:

Star  
 Constellation  
 Culmination  
 Pole Star  
 Zodiac  
 Galaxy  
 Parallax  
 Variable Star  
 Astro-Photography

THE NEBULAE are faintly shining cloudlike patches of matter in the sky, scattered among the stars. They are supposed to be stars under formation. The nature, forms, and magnitudes of nebulae, the spectra, distribution, distance, etc., are treated in the article NEBULAE.

4. ASTRONOMICAL OBSERVATORIES are buildings where the instruments and machinery necessary for the observation of the heavenly bodies are kept. The equipment, location, etc., together with a description of some of the largest observatories in the world, are treated in the following articles:

Observatory  
 Lick Observatory

Naval Observatory  
 Pulkova  
 Yerkes Observatory  
 Greenwich Observatory  
 Harvard College Observatory  
 Mount Wilson Solar Observatory

5. COSMOGONY deals with the theory of operations by which the present condition of the universe came about. Various systems of cosmogony have prevailed at different times. See:

Cosmogony  
 Nebulae

6. ASTROLOGY deals with the supposed influence of the heavenly bodies upon human affairs and the drawing of horoscopes. Astrology was the forerunner of astronomy, and for centuries astronomical observations were made mainly to supply data for astrology. See ASTROLOGY.

#### 7. BIOGRAPHY.

Observational astronomy dates back to the Chinese and Chaldeans, but the first real attempt to explain the movements of the heavenly bodies is due to the Greeks. The ideas of the Greeks held sway till Copernicus substituted a more harmonious system. Gravitational astronomy begins with Newton, who made it possible to explain the movements of the heavenly bodies, while Galileo's invention of the telescope gave a means of finding out what they are in themselves. The following is a list of the most prominent contributors to astronomy:

Hipparchus  
 Ptolemy  
 Brahe  
 Kepler  
 Galileo

Galileo  
Newton  
Bradley  
Halley  
Roemer  
Cassini, Jacques  
Cassini, G. D.  
Flamsteed  
Herschel, Sir William  
Herschel, Sir J. F. W.  
Laplace  
Bessel  
Bode  
Delambre  
Olbers  
Piazzi  
Pond

Baily  
Hansen  
Struve, F. G. W.  
Encke  
Leverrier  
Adams, J. C.  
Airy  
Rosse  
Rutherford  
Struve, Otto  
Galle  
Huggins  
Lockyer  
Gill, Sir David  
Pickering  
Hale, G. E.



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# Chapter 16. Physics

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**I**N undertaking systematic reading in any particular science, it is well at the outset to realize the province and limitations of that science, as they have been determined and observed in the past by its devotees, and what, if there have been changes, is the modern conception of the scope of the particular department of knowledge so known. With this especial object, the article on PHYSICS has been written, and serves to introduce the reader to the subject, as discussed in more detail under the broad subdivisions of ACOUSTICS, ELECTRICITY, HEAT, LIGHT, MECHANICS, LABORATORY, MAGNETISM and RADIOACTIVITY. Taking up these subjects separately, and also the article on LABORATORY, we shall find in each case the general article referred to, and such minor articles as are demanded.

## 1. ACOUSTICS.

Dealing with theoretical questions, the more important topics on the nature and theory of sound are included in the following list:

- Acoustics
- Section *Origins* under Music
- Diatonic Scale
- Phonetics
- Resonance
- Resonator
- Node

For special purposes and investigation dealing with the production and propagation of sound waves, there has been devised much interesting apparatus, certain forms of which, as the telephone, phonograph, megaphone, etc., have found their way into universal application. See:

- Siren
- Speaking Trumpet
- Megaphone
- Ear-Trumpet
- Acoumeter
- Phonograph
- Talking Machine
- Graphophone
- Telephone
- Tuning-Fork
- Organ

## 2. ELECTRICITY.

To supplement the general article ELECTRICITY, and those of a theoretical nature treating Ionization and Electrons, it is desirable to consult articles dealing with the generation of the current, as DYNAMO-ELECTRIC MACHINERY, the VOLTAIC CELL, the DRY PILE, THERMO-ELECTRICITY, and also study the effects of INDUCTION and self-induction. We can learn how the magnetic strength of a solenoid is influenced by the number of AMPERE TURNS. As supplemental, then, to the article on electricity, the following articles may be cited:

### (a) *Fundamental Phenomena:*

- Current
- Conductor
- Resistance
- Shunt
- Electrostatics (under Electricity)
- Condenser
- Ampere Turns
- Solenoid
- Induction
- Induced Electric Currents (under Electricity)
- Foucault Currents

### (b) *Electrical Units:*

- Electrical Units

Ampere  
 Volt  
 Ohm  
 Henry  
 Farad  
 Coulomb  
 Watt

(c) *Electrostatic Apparatus:*

Electrophorus  
 Electrical Machine  
 Electroscope  
 Leyden Jar (under Condenser)  
 Barometric Light  
 Brush  
 Elmo's Fire, Saint

(d) *Measuring Instruments:*

Galvanometer  
 Ammeter  
 Voltmeter  
 Voltameter  
 Wheatstone's Bridge  
 Electrometer  
 Electric Meters  
 Induction Balance

(e) *Discharge in Gases or in Vacuo:*

Anode  
 Discharge through Gases (under Electricity)  
 Geissler's Tubes  
 Crookes Tube  
 X-Rays

(f) *Electric Currents:*

Galvanic Battery  
 Voltaic Cell or Battery  
 Dry Pile  
 Storage Battery  
 Dynamo Electric Machinery  
 Thermo-Electricity  
 Thomson Effect

ence should be made to CALORIMETRY to ascertain how the amount of heat possessed by various bodies is measured, and to THERMOMETRY to learn how the temperature or degree of heat is determined. THERMODYNAMICS enables us to consider the relation between heat and work. See:

Heat  
 Calorimetry  
 Thermometry  
 Diathermancy  
 Regelation  
 Radiation  
 Thermodynamics  
 Spheroidal State

Of a more practical character, are those articles involving the consideration of methods and apparatus, such as those which discuss the LIQUEFACTION OF GASES and FREEZING MIXTURES. A list of this kind would include:

Cryophorus  
 Freezing Point  
 Freezing-Mixtures  
 Liquefaction of Gases  
 Melting-Point  
 Boiling-Point  
 Critical Point  
 Refrigeration  
 Zero  
 Thermometer  
 Pyrometer  
 Thermoscope  
 Microtasmeter  
 Radiation  
 Radiometer  
 Radiation Pressure  
 Bolometer  
 Hygrometer  
 Safety-Lamp

3. HEAT.

Following the arrangement already specified for the study of heat, refer-

#### 4. MAGNETISM.

Complete articles on **MAGNETISM** in general and on **TERRESTRIAL MAGNETISM**, with charts, leave but little to be said in addition. The instruments used in studying magnetism, and especially the ship's compass, with its important adjustments, are also the subjects of further description. See:

- Magnetism
- Terrestrial Magnetism
- Diamagnetism
- Compass
- Declination
- Declinometer
- Dipcircle
- Inclination
- Isoclinic
- Isogonic
- Magnetometer
- Magnetic Elements
- Magnetic Equator
- Magnetic Observatory
- Armature
- Alloys, Magnetic
- Astatic Needle

#### 5. LIGHT.

In the study of optics, there are numerous opportunities to branch off from a general treatment and carry on independent investigation in a particular field. Starting with the motion of the ether, known as light, we are able to study its **VELOCITY** and also the intensity. For the latter, photometers are employed, and the subject of **PHOTOMETRY** presents a record of many different instruments and methods. The useful application of light is included under **ILLUMINATION**. By reason of its wave motion when **DIFFRACTION** and **INTERFERENCE** take place **FRINGES** are formed, and also there re-

sults the phenomenon known as colors of thin plates. This principle of interference is the basis of one process of **COLOR PHOTOGRAPHY**; several processes are described under that title. In fact, numerous other examples could be cited, but reference to the following list will clearly indicate the extent of the range of subjects:

##### (a) *Light:*

- Light
- Velocity of Light
- Ether
- Diffraction and Diffraction Gratings
- Interference
- Fringes
- Colors of Thin Plates (under Light)
- Newton's Rings
- Photometry
- Reflection
- Caustic
- Refraction
- Polarization
- Prism
- Dispersion
- Color
- Complementary Colors
- Achromatism
- Rainbow
- Lens
- Foci
- Aberration, Chromatic
- Aberration, Spherical
- Spectroscopy
- Fluorescence
- Phosphorescence
- Zeeman Effect
- Mirage
- Fata Morgana

##### (b) *Optical Instruments:*

- Telescope
- Opera Glass

Field Glass  
 Object-Glass  
 Eyepiece  
 Field of View  
 Microscope  
 Solar Microscope  
 Camera Lucida  
 Camera Obscura  
 Aplanatic Lens  
 Spectroscope  
 Stereoscope  
 Magic Lantern  
 Moving Pictures  
 Kinetoscope  
 Dissolving Views  
 Diaphragm  
 Polariscope  
 Nicol Prism  
 Analyzer  
 Polar Clock  
 Kaleidoscope  
 Chromatope  
 Zoëtrope  
 Fluoroscope  
 Diaphanoscope  
 Cyanometer  
 Dioptrimeter  
 Magic Mirror of Japan

(c) *Photographic Processes:*

Photography  
 Photo-Chemistry  
 Negative  
 Ambrotype  
 Daguerreotype Process  
 Copying  
 Color Photography  
 Photo-Engraving  
 Calotype Process  
 Cyanotype Process  
 Ferrottype  
 Fothergill Process  
 Photolithography (under Li-  
 thography)  
 Gelatin Process

6. MATTER AND MECHANICS.

Under this head, we may include a consideration of matter, including its general properties and the theories advanced to explain it, as well as the questions concerned with the motion of matter, and the methods and units employed to measure this motion. Considering the first subdivision, it is necessary to concern ourselves with the following titles:

Matter  
 Vortex  
 Molecules  
 Inertia  
 Porosity  
 Ductility  
 Elasticity  
 Flexure  
 Viscosity  
 Gases, General Properties of  
 Effusion  
 Cohesion  
 Adhesion

The science of mechanics deals with the motion of matter. After reading the fundamental article **MECHANICS**, the reader will be prepared to appreciate the associated articles as well as those dealing with the various stages of applied mechanics. Included in the former class, are the following:

Mechanics  
 Dynamics  
 Kinetics  
 Kinematics  
 Statics  
 Moment  
 Momentum  
 Velocity  
 Acceleration  
 Force  
 Potential

Central Forces

Couple

Energetics

Centre of Gravity

“ “ Gyration

“ “ Inertia

“ “ Oscillation

“ “ Percussion

“ “ Pressure

Aerostatics

Aerodynamics

Pneumatics

Hydrostatics

Hydrodynamics

Vortex

Waves

Stability

Impact

Gravitation

Falling Bodies

Vector

Capillarity

Mechanical Powers

Inclined Plane

Lever

Wheel and Axle

Pulley

Pendulum

Projectiles, Motion of

In order to measure motion and its effect, there are required systems of units, and these are usually arranged on such a basis that they are parts of a symmetrical system, such as the C. G. S. (Centimeter, Gramme, Second) system. This matter is fully explained in the following articles:

C. G. S.

Mechanical Units

Dimensions

Dyne

Erg

Foot-Pound

Joule

Watt

Kilowatt

Horse-Power

For the measurement and study of matter and its motion and other properties, numerous important pieces of physical apparatus have been devised. Thus, to measure the pressure of the atmosphere, or a gas, we have the BAROMETER and the MANOMETER. To remove the air from a vessel, the AIR PUMP is applied. For the linear measures, we have scales constructed with the DIVIDING ENGINE and compared with standards on the COMPARATOR. Instruments of such nature are included in the following list:

Air Pump

Barometer

Barometer, Water

Aneroid

Manometer

Magdeburg Hemispheres

Specific Gravity

Hydrometer

Jolly Balance

Balance

Spring Balance

Weighing Machine

Torsion Balance

Weights and Measures

Metric System

Dividing Engine

Comparator

Atwood's Machine

Barker's Mill

Hero's Fountain

## 7. MODERN THEORIES.

Modern Physics has many recent developments to record in the field of theory and many of the ideas once considered fixed and definite have been put to the test severely under later

conditions. Even GRAVITATION, whose laws were once considered fundamental, has been considered in the light of modern thought, while the recognition of the ELECTRON and the part played by IONIZATION has modified our original idea of ELECTRICITY and the ETHER. Furthermore, we have the new conception of RELATIVITY. Whatever the existence of matter and its explanation, yet when electrical oscillations take place or material bodies emit energy, or as it is termed, RADIATION, a wide range of phenomena is produced ranging from the Electromagnetic waves used in WIRELESS TELEGRAPHY and TELEPHONY to the waves of light. When the radiations are produced by the discharge of electricity through a vacuum we have the phenomena of the X-rays, while if the radiations are furnished spontaneously, as by such radioactive elements as RADIUM, THORIUM, etc., there are afforded the varied series of phenomena that would seem to indicate transformation of one element to another and bear an important relation to the theory and explanation of matter. Accordingly, in this connection, one could read with profit the articles on:

- Ether
- Gravitation
- Relativity
- Radiation
- Radiation Pressure
- Radium
- Radioactivity
- Electricity
- Light
- X-rays
- Waves

RADIOACTIVITY, by reason of its relation to theories of matter and the

involved phenomena, both physical and chemical, is now entitled to stand as a distinct Department of Physics, in so far as the physical phenomena are concerned.

The main article on this subject deals with the theories which have been advanced to explain the many interesting phenomena of the Radioactive substances. Accordingly one should read, in addition to this article, those on the various Radioactive elements, such as:

- Radium
- Uranium
- Actinium (particularly)
- Thorium
- Polonium

The biographies of the leading workers in this field, such as the Becquerels, Sir William Crookes, Professor and Madame Curie, Ernest Rutherford, Frederick Soddy and J. J. Thomson, and others referred to in the various articles, should also be read.

## 8. BIOGRAPHIES OF PHYSICISTS.

Some of the greatest achievements in that branch of science which is now known as Physics have been the work of philosophers who have also accomplished much in other fields, and consequently it is impossible, particularly in the case of ancient and mediæval scientists, to term them physicists, and include them in such a list. Also, in modern times, the work of the chemist, of the engineer, of the meteorologist, of the astronomer, and of other scientific workers, closely approaches or actually transgresses the limits which the physicist has set for himself. Therefore, the following list does not include all the principal workers, but a

certain number who primarily are distinguished for their work in physics.

Abney, W. de W.  
Amici, G. B.  
Amontons, G.  
Ampère, A. M.  
Arago, D. F.  
Archimedes  
Atwood, George  
Bache, Alex. D.  
Bacon, Roger  
Becquerel, A. C.  
Becquerel, A. E.  
Becquerel, A. H.  
Bell, A. G.  
Biot, Jean B.  
Boyle, Robert  
Brewster, Sir D.  
Bunsen, R. W.  
Cailletet, L. P.  
Carhart, H. S.  
Carnot, N. L. S.  
Cavendish, H.  
Chladni, E. F. F.  
Clausius, R. J. E.  
Coulomb, C. A.  
De la Rive, A. A.  
Dollond, John  
Dove, H. W.  
Edison, T. A.  
Ewing, J. A.  
Fahrenheit, G. D.  
Faraday, M.  
Ferrari, G.  
Fleming, J. A.  
Forbes, J. D.  
Foucault, J. B. L.  
Fraunhofer, Joseph von  
Fresnel, A. J.  
Galvani, L.  
Gauss, K. F.  
Gay-Lussac, J. L.  
Geissler, H.  
Gilbert, W.

Glazebrook, R. T.  
Gray, Elisha  
Grove, Sir W. R.  
Guericke, O. von  
Haidinger, W. von  
Halley, E.  
Hauksbee, F.  
Helmholtz, H. von  
Henry, Joseph  
Hero of Alexandria  
Herschel, Sir W.  
Hertz, H.  
Hittorf, J. W.  
Holtz, W.  
Hopkinson, J.  
Huygens, C.  
Jenkin, H. C. F.  
Jolly, P. von  
Joule, J. P.  
Kater, H.  
Kirchhoff, G. R.  
Kohlrausch, F.  
Kundt, A.  
Laplace, P. S. de  
Leslie, Sir J.  
Lodge, Sir O. J.  
Magnus, H. G.  
Malus, E. L.  
Mariotte, E.  
Mascart, E. E. N.  
Maxwell, J. C.  
Mayer, A. M.  
Mayer, J. R. von  
Mendenhall, T. C.  
Michelson, A. A.  
Morse, S. F. B.  
Newton, Sir Isaac  
Nichols, E. L.  
Oersted, H. C.  
Ohm, G. S.  
Ostwald, W.  
Papin, D.  
Pictet, R.  
Plateau, J. A. F.

Pupin, M. I.	Thompson, S. P.
Quincke, G. H.	Thomson, Sir J. J.
Rankine, W. J. M.	Thomson, William (Lord Kelvin)
Rayleigh, J. W. S.	Torricelli, E.
Réaumur, R. A. F. de	Trowbridge, J.
Regnault, H. V.	Tyndall, J.
Roentgen, W. K.	Van't Hoff, J. H.
Rowland, H. A.	Violle, J.
Rühmkorff, H. D.	Volta, A.
Sabine, Sir E.	Watt, J.
Siemens, Sir W.	Weber, W.
Somerville, Mary	Whcatstone, Sir Charles
Steinheil, K. A.	Wiedemann, G.
Stevin, S.	Wilde, H.
Stokes, Sir G. G.	Woodward, R. S.
Tait, P. G.	Wroblewski, Z. F.
Tesla, N.	Young, T.



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## Chapter 17. Aëronautics

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**I**N only a very recent work of reference would it be possible to assemble a number of articles dealing with the modern theory and art of aërial navigation. Indeed, the practice of aëronautics has been so affected by the great War in Europe that the military and naval aspects of the matter have become predominant, and while the mechanical features are closely connected, yet the general reader at the present time is likely to be more concerned with the use of the aëroplane and dirigible in warfare.

In the *NEW INTERNATIONAL ENCYCLOPÆDIA* the student will find first a general article on *AËRONAUTICS*, in which the history of the evolution of the dirigible or airship from the balloon and of the aëroplane, from the earliest attempts at securing flight with a machine heavier than the displaced air, is traced. He will also find in the article on *GASES, GENERAL PROPERTIES OF*, the fundamental theory involved, and in the articles on *MILITARY and NAVAL AËRONAUTICS* the applications to warfare. In the section on *Aërial Operations*, in the long article on the *WAR IN EUROPE*, will be found a discussion of the use made of these machines in reconnaissance and combat.

The successful evolution of machines that could navigate air also has brought about legal problems and indicated changes both in international law and in other statutes or principles of law involved in the rules of the road and other obvious practices. Accordingly, a list of useful articles for one engaged in research in this field would be the following:

Aëronautics  
Aërodynamics  
Aërostatics  
Military Aëronautics  
Hangar  
Navigation, Aërial, Law of  
International Law

War in Europe (Section on Aërial  
Operations)  
Gases. General Properties of  
Internal Combustion Motors  
Military or Man-Raising Kite  
Kite

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## Chapter 18. Chemistry

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**T**HE importance, for practically everybody, of acquiring a knowledge of chemistry hardly needs to be emphasized. Chemical facts and principles are involved, to a considerable extent, in every science and in every branch of industry, and chemical questions come up often in nearly every sphere of human activity.

In the *NEW INTERNATIONAL ENCYCLOPÆDIA* the science and applications of chemistry are treated in a large number of articles, many of which were written so as to serve a double purpose: first, to supply information on their special topics, without reference to chemical science as a whole, or to any other chemical topic; secondly, to form integral parts of an exposition of chemistry, for those who may desire to use the *Encyclopædia* for the acquisition of a general acquaintance with the subject. To serve the second purpose, they were written from a single viewpoint—on the whole, that of the German school of physical chemistry, now all but universally recognized as the best founded and most fruitful mode of viewing chemical phenomena. To serve the first purpose, which is all-important in a work of reference, each article (with few unavoidable exceptions), besides being written in simple terms, is supplied with all the information that is necessary to an understanding of the subject it treats, so that in most of the articles, no preliminary chemical knowledge is pre-supposed. But even in those articles in which the assumption of some preliminary knowledge could not, for obvious reasons, be avoided, no information was pre-supposed beyond what may be readily found in the *Encyclopædia* itself. Furthermore, in most of the articles the more essential information is concentrated in the opening paragraphs, the more technical and less essential in later parts of the article; so that glancing over the first paragraph alone may be sufficient for many purposes. If the end in view be the acquisition of some general knowledge of chemistry, the articles should be read entirely and carefully and the leading points briefly noted down, so as to afford, at any time of the reading, a clear retrospect over the ground covered.

For purposes of systematic reading, the chemical articles in the *Encyclopædia* may be grouped as follows: 1, Those dealing with general fundamental principles; 2, those dealing with the principal classes of carbon compounds; 3, those dealing with the theories of physical chemistry; 4, those articles, or sections of articles, dealing with the history of chemistry; 5, articles on the chemical elements; 6, articles on the principal compounds occurring in the living organism; 7, articles on other substances, inorganic and organic, presenting either theoretical or practical interest. In the following chapter devoted to *INTERNATIONAL CHEMISTRY*, as well as in the section on *Manufactures*, will be found listed and discussed the articles that deal with modern industrial processes and their products.

The order of this classification is the general reader, of principles and based on the relative importance, to facts. Should the course of syste-

matic reading be interrupted at some stage, a knowledge of at least some of the principles of chemistry ought to be much more valuable than a knowledge of some data concerning individual compounds, such as would be acquired if, following the usual order of chemical studies in schools, the course should be commenced by a perusal of the descriptive articles on the elements and their principal inorganic compounds.

### 1. FUNDAMENTAL PRINCIPLES AND PHENOMENA.

- Chemistry
- Analysis, Chemical
- Atomic Weights
- Avogadro's Rule
- Molecules
- Periodic Law
- Spectrum Analysis
- Reaction, Chemical
- Decomposition
- Dissociation
- Catalysis
- Nascent State
- Combustion
- Spontaneous Combustion

### 2. CARBON COMPOUNDS.

The compounds of carbon, numbering roughly 150,000, form the subject of organic chemistry, one of the most extensive and important branches of modern chemical science. In this branch the atomic and other theories have found a field for some of their most useful applications; and it is, therefore, advisable to acquire some knowledge of it at any early stage in chemical reading. The following is a list of the principal articles dealing with this branch; to be supplemented,

of course, on the practical side by those dealing with industrial processes as given in the following chapter:

- Carbon Compounds
- Stereo-Chemistry
- Alcohols
- Mercaptans
- Ethers
- Aldehydes
- Ketones
- Amines
- Amides
- Ureas
- Valence
- Carbohydrates
- Phenols
- Organo-Metallic Bodies
- Alkaloids

### 3. PHYSICAL CHEMISTRY.

Within recent years, physical chemistry has attained a degree of importance which makes some knowledge of it indispensable.

It is believed that this justified the introduction in the Encyclopædia of a somewhat extensive treatment of the subject. Following is a list of the principal articles, in the order in which it would seem advisable to read them:

- Avogadro's Rule
- Boiling-Point
- Freezing-Point
- Melting-Point
- Solution
- Dissociation
- Colloids
- Thermo-Chemistry
- Phase Rule
- Electro-Chemistry, General
- Photo-Chemistry
- Critical Point
- Evaporation

Distillation  
Sublimation  
Radioactivity

#### 4. HISTORY OF CHEMISTRY.

The history of a great science, if studied after some knowledge of the principles and problems of the science has been acquired, has in itself a fascination for almost every mind. But, in the case of chemistry, many authorities have maintained that a knowledge of the history is not merely interesting, but absolutely indispensable to a thorough understanding of the science itself. In the *Encyclopædia*, a simple presentation of the development of chemical thought, and the gradual elimination of past errors of principle and method, will be found in the general article CHEMISTRY. Further historical information will be found in the article ALCHEMY, in the articles on physical chemistry, in those describing the elements and many chemical compounds, and especially in the biographies of celebrated chemists. Following is a list of some of the best-known names in the history of chemistry:

Helmont, J. B. van  
Becher, J. J.  
Stahl, G. E.  
Black, J.  
Priestley, J.  
Cavendish, H.  
Lavoisier, A. L.  
Klaproth, M. H.  
Dalton, J.  
Wollaston, W. H.  
Berzelius, J. J.  
Davy, H.  
Berthollet, C.  
Avogadro, A.  
Gay-Lussac, J. L.

Mitscherlich, E.  
Liebig, J.  
Wöhler, F.  
Chevreul, M. E.  
Dumas, J. B.  
Laurent, A.  
Gerhardt, K. F.  
Gmelin, L.  
Sainte-Claire Deville, H. E.  
Cannizzaro, S.  
Graham, T.  
Kolbe, H.  
Bunsen, R. W.  
Roscoe, H. E.  
Berthelot, P. E. M.  
Wurtz, C. A.  
Hofmann, A. W.  
Regnault, H. V.  
Pasteur, L.  
Mendeléeff, D.  
Schorlemmer, C.  
Baeyer, A.  
Fischer, E.  
Van't Hoff, J. H.  
Ostwald, W.  
Nernst, W.  
Arrhenius, S.  
Curie, M. S. and P.  
Crookes, W.  
Ramsay, W.

#### 5. THE CHEMICAL ELEMENTS.

The articles on the chemical elements will be found to contain descriptions, not only of the elements themselves, but also of their principal compounds, so that each article forms a chapter of inorganic chemistry. Following is a list of some of the principal articles in a recognized order of arrangement:

Hydrogen  
Oxygen  
Nitrogen  
Carbon

Chlorine  
Bromine  
Iodine  
Fluorine  
Sodium  
Potassium  
Lithium  
Magnesium  
Calcium  
Strontium  
Barium  
Zinc  
Cadmium  
Mercury  
Boron  
Aluminium  
Silicon  
Tin  
Lead  
Zirconium  
Thorium  
Phosphorus  
Arsenic  
Antimony  
Bismuth  
Sulphur  
Selenium  
Tellurium  
Chromium  
Molybdenum  
Tungsten  
Uranium  
Manganese  
Iron  
Cobalt  
Nickel  
Platinum  
Palladium  
Copper  
Silver  
Gold

Articles on the rest of the elements, including the rare gases ARGON, HELIUM, NEON, KRYPTON, and XENON,

and of the radioactive elements, including RADIUM, POLONIUM, ACTINIUM, and THORIUM, will be found in their proper places. In connection with the radioactive elements, reference should be made to the article on RADIOACTIVITY. A list of the elements, with their chemical symbols and atomic weights, will be found in the article ATOMIC WEIGHTS.

#### 6. COMPOUNDS OCCURRING IN LIVING ORGANISMS.

Physiological chemistry deals with the individual compounds forming the chemical ingredients of the materials of which living organisms and their products (*e. g.*, milk) are made up. A knowledge of the chemical and physical properties of those compounds is indispensable in the study of chemical physiology, and hence of physiology in general. The following is a list of the more important physiological compounds described under their names in the Encyclopædia:

Albumen  
Allantoïn  
Carbohydrates  
Cellulose  
Carnin  
Casein  
Cerebrin  
Chitin  
Cystin  
Elastin  
Fats  
Fibrin  
Gelatin  
Globulins  
Glycogen  
Guanin  
Hypoxanthin  
Keratin

Kreatin  
Kreatinin  
Legumin  
Leucin  
Ossein  
Proteins  
Starch  
Syntonin  
Taurin  
Urea  
Uric Acid  
Hæmatin  
Hæmoglobin

Trimethylamine  
Aniline  
Pyridine  
Quinoline  
Alkaloids  
Ptomaines

The article ALKALOIDS contains a list of the important members of this class of substances, with their principal characteristics. More extensive descriptions are given in the special articles on all the more important alkaloids.

#### 7. OTHER IMPORTANT ARTICLES ON CHEMICAL SUBJECTS.

##### (a) *Metallic Alloys:*

Alloy  
Amalgam  
Babbitt Metal  
Brass  
Britannia Metal  
Bronze  
Fusible Metal  
German Silver  
Phosphor-Bronze  
Pewter  
Pinchbeck  
Platiniridium  
Spence's Metal

##### (b) *Bases:*

The inorganic bases, *i. e.*, metallic oxides and hydroxides, are mostly described in connection with the metallic elements. Important special articles are:

Ammonia  
Lime  
Soda

The articles on organic bases include:

Amines  
Ethylamine

##### (c) *Acids:*

All the more important acids are described in special articles under their names. Many acids of secondary importance are mentioned in connection with their characteristic elements. Following is a partial list of important articles on acids:

##### i. General:

Acids  
Phenols

##### ii. Inorganic:

Sulphuric Acid  
Hydrochloric Acid  
Nitric Acid  
Sulphureted Hydrogen  
Phosphoric Acid  
Hydrobromic Acid  
Hydriodic Acid  
Hydrofluoric Acid  
Chloric Acid  
Perchloric Acid  
Hypochlorous Acid  
Nitrous Acid  
Hyponitrous Acid  
Phosphorous Acid  
Hypophosphorous Acid  
Manganic and Permanganic  
Acids

## iii. Organic:

Acetic Acid  
 Benzoic Acid  
 Butyric Acid  
 Caproic, Caprylic, and Capric Acids  
 Carbolic Acid  
 Carbonic-Acid Gas  
 Cinnamic Acid  
 Citric Acid  
 Cyanic Acid  
 Cyanuric Acid  
 Formic Acid  
 Fumaric and Maleic Acids  
 Gallic Acid  
 Glycin  
 Hippuric Acid  
 Hydrocyanic Acid  
 Hydroferricyanic Acid  
 Hydroferrocyanic Acid  
 Lactic Acid  
 Lauric Acid  
 Malic Acid  
 Margaric Acid  
 Meconic Acid  
 Myristic Acid  
 Senanthylic Acid  
 Oleic Acid  
 Oxalic Acid  
 Palmitic Acid  
 Picric Acid  
 Stearic Acid  
 Succinic Acid  
 Tannic Acid  
 Tartaric Acid  
 Uric Acid  
 Valeric Acid

An important "homologous series" of acids, included in this list, is constituted by the following so-called "fatty acids":

Formic  
 Acetic

Butyric  
 Valeric  
 Caproic  
 Caprylic  
 Capric  
 Senanthylic  
 Lauric  
 Myristic  
 Palmitic  
 Margaric  
 Stearic

Allied to the last-named is Oleic Acid.

The acid anhydrides are mostly mentioned in connection with the metalloïd elements.

*(d) Salts:*

Salts are mostly described in connection with either the acids or the bases combined in them. The following are a few special articles on salts:

Alum  
 Borax  
 Cream of Tartar  
 Epsom Salt  
 Glauber's Salt  
 Iodides  
 Rochelle Salt  
 Ichthyol  
 Saltpetre  
 Soda

Bases, acids, and salts constitute together the so-called "electrolytes." Their peculiar behavior in aqueous solutions has led to the formulation of the now well-known theory of electrolytic dissociation, which may be found treated in the articles SOLUTION, DISSOCIATION, and ACIDS.

*(e) Hydrocarbons:*

Hydrocarbons  
 Methane

Ethane  
Propane  
Butane and Isobutane  
Ethylene  
Acetylene  
Benzene  
Naphthalene  
Anthracene

Further information concerning hydrocarbons may be found in articles on such products as oils (volatile), paraffin, ozokerite, petroleum, benzine, rubber, gutta-percha, gas (illuminating and natural), etc.

*(f) Other important compounds:*

Water  
Hydrogen Dioxide  
Ozone  
Alcohol  
Methyl Alcohol  
Glycerin  
Mannite  
Aldehyde  
Chloral  
Acetone  
Almonds, Volatile Oil of  
Acrolein  
Acetone  
Ether  
Chloroform  
Iodoform  
Nitro-Benzene  
Carbides  
Calcium Carbide  
Carbon Disulphide  
Carbonic Oxide  
Cyanogen

*(g) Pigments, Dyestuffs, and Allied Subjects:*

Paints  
Mineral Colors  
Vegetable Colors

Dyeing  
Mordants  
Coal-Tar Colors  
Tar  
Coal Tar  
Indigo  
Alizarin  
Purpurin  
Aurin  
Rosolic Acid  
Archil  
Arnotto  
Carmine  
Cochineal  
Flavin  
Fustic  
Henna  
Indian Yellow  
Lac Dye (under Lac)  
Litmus  
Madder  
Orcin  
Orcein  
Logwood  
Murexid  
Phenicin  
Quercitron  
Green  
Brunswick Green  
Turkey Red  
Cinnabar  
Blue  
Indigo  
Lampblack  
White Lead

A list of the widely used coal-tar colors ("aniline dye-stuffs"), with their principal characteristics, will be found in the article COAL-TAR COLORS.

*(h) Waxes, Fats, Oils, and Soap:*

Waxes  
Beeswax  
Spermaceti



Fats  
Palmitin  
Stearin  
Olein  
Oils  
Almonds, Expressed Oil of  
Almonds, Volatile Oil of  
Canada Balsam  
Castor Oil  
Cod-Liver Oil  
Croton Oil  
Garlic, Oil of  
Grass-Oil  
Gurjun Balsam  
Lemon Oil  
Menthol  
Petroleum  
Turpentine  
Wintergreen, Oil of  
Soap

All the typical waxes and oils are described in the general articles under these names. Paraffin, which is sometimes spoken of as "paraffin wax," is described in an article under its own name.

(i) *Gums and Resins:*

Gums  
Resins  
Amber  
Ammoniac  
Anime  
Arabin  
Copal  
Bassora Gum  
Bdellium  
Catechu  
Dragon's Blood  
Gambir  
Gamboge  
Gum Arabic (under Gums)  
Kino  
Mucilage

Olibanum  
Podophyllin  
Rosin  
Sandarac  
Scammony

Camphor, which is sometimes spoken of as "gum camphor," is described under its own name. "British gum," a substitute for gum arabic, is described under DEXTRIN.

(j) *Explosives:*

The chemistry of EXPLOSIVES, both those employed for military purposes and in mining and other industries, represents a field in which the theoretical and technological advances have been extraordinary, and the new compounds that the chemist has invented have played their part in peace and war. In no department of chemistry have there been more interesting developments than in the theory of Explosives and the various groups into which modern Explosives are classified all present interesting theoretical considerations for the chemist.

Accordingly, the student interested in the history, classification and theory of Explosives, and wishing to learn of the various explosive mixtures, of the nitrates, of the chlorates and perchlorates, and compounds derived by nitro-substitution, and those compounds known as nitro-derivatives, as well as smokeless powders, nitroglycerin, fulminates and amides, should read the article on EXPLOSIVES, which not only discusses theory, but the growth of the industry in the United States and the use of Explosives in industry, such as for blasting and mining, and the regulations attending their transportation and stor-

age. Of course, the older forms of Explosives are discussed under gunpowder, while GUNCOTTON, NITRO-GLYCERIN and NITRO-CELLULOSE show the application of these substances to this branch of chemistry. *Dynamite* is typical of the articles on high power explosives, while the article on TRINITROTOLUENES describes one of the latest of the powerful military explosives.

An appropriate list for careful reading in this department would be as follows:

Dualine  
Dynamite  
Extralite  
Explosives  
Emmensite  
Nitroglycerin

Guncotton  
Gunpowder  
Melinite  
Lyddite  
Magazine  
Nitrocellulose  
Pyroxylin  
Stemming  
Trinitrotoluenes

(k) *Waters:*

Water  
Ice  
Distilled Water  
Aërated Waters  
Carbonated or Acidulous Waters  
Chalybeate Waters  
Mineral Waters  
Selters Water  
Apollinaris Water

Many of the foregoing articles are concerned either with theory or with the nature and composition of various chemical elements or substances, apart from their uses in the arts, where the labors of modern research chemists have found wide and useful application. Accordingly, the following chapter on INDUSTRIAL CHEMISTRY will take up some of the more important substances and processes that enter into modern technology.

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# Chapter 19. Industrial Chemistry

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**H**AVING mastered the underlying principles and more important facts of chemistry, such as the nature of the various elements, the conditions under which they exist and the laws under which they combine, and the most generally and commonly employed chemical substances, the reader interested in the practical applications of this vast field of theoretical science naturally will desire information as to the extent to which scientific chemistry figures in the arts, and some description of the various technological processes involved in wholesale production. Methods of manufacture representing theory reduced to practice often involve the results of the most refined research and scientific investigation, by which everyday materials are produced for general use and the benefit of mankind. Vast industries involving both inorganic and organic chemistry have been built up on the labors of the scientist, and as trade follows the flag so manufacturing prosperity follows and in large measure depends on the labors of the industrial chemist.

The reader of this department in *THE NEW INTERNATIONAL ENCYCLOPEDIA*, who first has studied the leading articles of the last chapter, probably would be best served by taking up first the articles dealing with the various processes of industrial chemistry, noting especially how the methods of the factory differ from those of the laboratory.

Leading articles in this field would be:

Lixiviation  
Evaporation  
Distillation  
Sublimation  
Filter and Filtration  
Filter Press  
Bleaching  
Calcining  
Refrigeration  
Roasting  
Electro-Chemistry

## FUEL.

Then, as heat plays an important part in all industry, chemical and other, a study of fuels would be next in order. Fundamentally and generally these are discussed in the article on *FUEL*. There are articles on the various solid and liquid fuels to which reference should be made for the im-

portant by-products involved, as in the case of the coal-tar colors, ammonia, hydrocarbons and other substances from the coal gas plants and coke ovens. These represent quite an important field of chemistry. Therefore, it may be suggested that the articles be taken up as follows:

### *Solid Fuels:*

Charcoal  
Coal  
Anthracite  
Bituminous Coal  
Tar  
Lignite  
Coal Tar  
Coke  
Peat

### *Liquid Fuels:*

Alcohol

Petroleum  
Kerosene  
Oil

*Gaseous Fuels:*

Gas, Illuminating and Fuel  
Acetylene  
Calcium Carbide  
Gas Engine  
Internal Combustion Engine  
Motor Vehicle

**WATER.**

The Industrial Chemist after fuel is next concerned with Water. It may be hard or soft, saline or alkaline, suitable or unsuitable for use in a boiler, or having special properties making it desirable in the manufacture of such beverages as beer and ale. Its purification may require a wide range of special processes ranging from chlorination to distillation. Accordingly, a suitable line of reading would be somewhat as follows:

Water  
Water Supply  
Water Purification  
Water Works  
Distillation  
Filter and Filtration  
Boiler  
Boiling Point  
Mineral Waters  
Bottling

**COMMON CHEMICALS.**

In Industrial Chemistry there are a number of rather common chemicals, but with a vast economic importance, for they enter so largely into manufacturing that they are always in constant demand and use. A few of these groups may be studied at some length. Thus—Sulphur, whose mining, extrac-

tion and purification are all problems in chemical engineering, has a number of important compounds, of which the best known industrially are found in the accompanying list:

Sulphur  
Sulphureted Hydrogen  
Sulphuric Acid  
Sulphurous Acid  
Thiosulphuric Acid

Found widely in nature, SALT is an important substance and common salt or Sodium Chloride is used not only for food, but in the manufacture of Soda Ash, Sodium Carbonate, and other substances. Consequently, the articles

Sodium  
Salt  
Soda

should be read, it being noted that under these a number of Sodium compounds are treated.

The Chlorine industry involves the preparation of substances used extensively in the arts as a bleaching or oxidizing agent, and the liquid chlorine in addition has been employed extensively as an asphyxiant in the great European War. See:

Chlorine  
Chloric Acid  
Chlorites  
Chlorimetry  
Hydrochloric Acid  
Hypochlorous Acid  
Sal Ammoniac  
Mercuric Chloride  
Mercurous Chloride  
Bleaching Powder  
Chloridizing  
Chlorination

The various compounds of calcium supply to the arts a large number of important materials, including **MARBLE** and other **BUILDING STONES**, **LIMESTONE** for iron and lead smelting, **GYPNUM** or **PLASTER OF PARIS** (Lime Sulphate), **CEMENT**, in which Lime is the principal ingredient, **BLEACHING POWDER** or **CHLORIDE OF LIME**, **MORTAR**, in which Lime enters largely, and so on through an extensive list. In practically all of these purposes there is work for the industrial chemist, whether it involves the calcining of the material in a kiln to form cement or the study of concrete, now used so largely for structural work. Consequently, the reader who follows through the various articles on Calcium and its compounds as given below will realize their industrial importance:

- Lime
- Limestone
- Marble
- Building Stone
- Marl
- Chalk
- Calcite
- Iceland Spar
- Gypsum (Lime Sulphate)
- Bleaching Powder (Lime Chloride)
- Cement
- Kiln
- Mortar
- Concrete
- Masonry
- Plaster of Paris
- Plaster, Lathing and Plastering
- Calcium Carbide
- Fertilizers
- Manures and Manuring
- Iron and Steel, Metallurgy of
- The Destructive Distillation of wood

affords a number of important products, among which is acetic acid, largely used in the manufacture of acetates. There are also a number of other or related substances, so that if we examine a rather broad group we find a number of valuable materials included. These may be embraced in the following list:

- Distillation
- Acetic Acid
- Acetine
- Methyl Alcohol
- Tar

The Destructive Distillation and other treatment of bones also affords useful chemical products. The use of bone products as fertilizers, the employment of bone black as a decolorizing agent in filtration, as in sugar refining, are specially important. The connection tissue in skin and bones is used in making gelatine, and the bones themselves are employed in making glue. Accordingly, if the articles enumerated below be consulted a substantial idea of this field of chemical technology will be gained:

- Bone
- Bone Black
- Bone Fertilizers
- Gelatin
- Glue

The industrial chemist has important work in connection with the manufacture of various artificial fertilizers which modern intensive agriculture demands. Naturally, this branch is closely connected with scientific agriculture and agricultural chemistry. Consequently, one will find in the accompanying list of articles much that will indicate how the chemist is assist-

ing the processes of nature. Such articles would be:

Manures and Manuring  
Bone Fertilizers  
Peat  
Ashes  
Phosphate  
Potash  
Kelp  
Cyanamid

#### INORGANIC INDUSTRIES.

In Industrial Chemistry the great division of inorganic and organic chemistry can be observed in considering the products of various industries. A certain number containing various groups have been entered specifically on these lists, but the main topics involved can be indicated together and then the reader can pursue his investigations further, depending both on the list in this Guide and on the elaborate cross references given with the articles. Under Inorganic Chemistry reference profitably can be made to the following main and more prominent articles:

Sulphur  
Sulphuric Acid  
Salt  
Hydrochloric Acid  
Soda  
Sodium  
Chlorine  
Nitric Acid  
Ammonia  
Potash  
Bromide  
Iodine  
Phosphorous  
Boric Acid  
Arsenic  
Oxygen

Peroxides  
Sulphates  
Alum  
Cyanides  
Carbon  
Carbon Disulphide  
Carbon Monoxide

#### MINERAL COLORS.

An important series of industries in Inorganic Chemistry involve the manufacture of pigments. The various chemicals entering into the more important of the pigments are discussed largely under MINERAL COLORS and separately as follows:

##### White:

White Lead  
White Chalk  
Lithopone  
Gypsum  
China Clay

##### Blue:

Ultramarine  
Smaltite  
Copper Indigo

##### Green:

Ultramarine  
Brunswick Green  
Chrome Green  
Malachite Green  
Verdigris  
Paris Green

##### Yellow:

Chrome Yellows  
Cadmium  
Litharge  
Gamboge  
Indian Yellow or Purree

##### Orange:

Chrome Orange

**Red:**

Red Lead  
 Chrome Red  
 Red Ochre  
 Vermilion  
 Realgar  
 Antimony Red  
 Carmine

**Brown:**

Umber  
 Sepia

**Black:**

Lampblack  
 Bone Black  
 Charcoal  
 Graphite

**ORGANIC INDUSTRIES.**

Industrial Chemistry is so closely connected with manufacturing and manufacturing processes that in any classification such as could be observed in an encyclopædia, it is very difficult to draw any satisfactory line of demarkation. Particularly is this the case in the large number of industries where organic chemistry plays an important part and underlies the various processes of manufacture.

Accordingly, the reader should refer to the chapter on MANUFACTURES AND ENGINEERING, where, under these various industries and products often the chemical technology is discussed. Such a list of organic industries would be as follows:

Distillation  
 Gas, Illuminating and Fuel  
 Coal Tar  
 Coal-Tar Colors  
 Mineral Oils

**Petroleum**

Waxes  
 Fats  
 Oils  
 Soap  
 Candle  
 Glycerine  
 Gums  
 Resins  
 Starch  
 Dextrin  
 Glucose  
 Sugar  
 Fermentation  
 Distilled Liquors  
 Beer  
 Brewing  
 Explosives  
 Fibres  
 Dyeing  
 Paper  
 Leather  
 Glue

**MINERAL OILS.**

The preparation and refining of Mineral Oils has produced a wealth of materials aside from the fuel oils proper, and one interested in this field after reading the comprehensive discussion on PETROLEUM will turn to other articles dealing with allied topics, as contained in the accompanying list:

Petroleum  
 Naphtha  
 Paraffin  
 Petrolatum  
 Vaseline  
 Shale Oil  
 Ozokerite  
 Mineral Tallow  
 Asphalt

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# Chapter 20. Home Economics and Domestic Science

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**I**T is but natural that the modern tendency to secure increased efficiency and, consequently, increased comfort and convenience should be manifested in the home through the application of scientific management and devices no less than in commerce and industry. In its latest aspects this finds full expression in the NEW INTERNATIONAL ENCYCLOPEDIA. Modern science has done much for the housekeeper, securing more nourishing and more economical foods, as well as as various labor-saving devices—such as SEWING MACHINES and VACUUM CLEANERS—that materially cut down the effort necessary to maintain and operate a domestic establishment. This concerns the small as well as the large householder, for electric light, gas heating and plumbing are all but universally found, and economic methods have been devised for the small city apartment or the isolated farm whereby the maximum well-being, comfort and economies generally can be obtained.

Modern *home economics* is not concerned alone with Food and its Preparation. The intelligent woman of to-day, managing a home, often arranges for its building, for the carpentry, heating, plumbing, wall paper, furniture and carpets and rugs, or for its lease if a rented dwelling, or a portion of an apartment house or hotel. If sufficiently large, the dwelling may involve electric heating, including electric cooking, vacuum cleaners or laundry machines, and in many of the modern homes may involve an organization as complex as a small business, and this involves a number of employees—male and female—to whom the principles of Master and Servant must apply. In a large part, however, Domestic Science has to do with food and its preparation, for it is here that the chemistry of nutrition has been brought to bear, and the wholesome and economical preparation of food is one of the main objects of the modern science of Household Chemistry.

Considering, therefore, the articles already suggested and others arranged in a convenient list for ready reference, we should have first the following, dealing with the home and its material equipment:

House  
Apartment House  
Tenement House  
Hotel  
Building  
Carpentry  
Heating and Ventilation  
Plumbing  
Electric Heater  
Electric Lighting  
Lighting

Illumination  
Vacuum Cleaner  
Water Supply  
Filter and Filtration  
Laundry Machinery  
Sewage Disposal

On the legal side, the householder should know something of the law dealing with such subjects as:

Deed



Title

Lease

Master and Servant

Supplied with a proper house and concerned with its management or with the management of an institution where features of home life and home conveniences must apply, one would be concerned with the articles on

Home Economics

Management, Home and Institution  
Coöperation

Marketing Associations, Agricultural

It is, however, on food and food supply that intelligent interest centers, for it is here that the high cost of living first makes itself apparent, not to mention that the appetite may prove the shortest road to a man's well being if not to his mind. One concerned with modern scientific food studies realizes that chemistry and physiology figure actively, so that a range of articles are available that are indeed comprehensive.

Food

Fish as Food

Diet

Digestion

Nutrition

Infants, Feeding of

Cookery

Baking

Baking Powder

Fireless Cooker

Food Preservation

Sterilized Food

Packing Industry

Slaughterhouse

Adulteration

Pure-Food Law

Prepared by the preceding rather general articles on Foods and Food-Stuff, the reader in this department will be ready to take up specifically a number of classes of Foods, or, in some cases, definite food substances. Such a list would include the grains and their products:

Barley

Buckwheat

Rye

Wheat

Maize

Rice

Flour

Bread

There would also be such important foods as

Milk

Cream

Butter

Butter Color

Butter Making

Oleomargarine

Cheese

Eggs

Meat

Meat Extract

Nuts

Fruits

Vegetables

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## Chapter 21. Interior Decoration and Decorative Art

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**W**ITHIN a few years there has developed in connection with, yet at the same time apart from, architecture and the fine arts increased interest in those æsthetic forms of expression that are found in the home or dwelling. While always recognized on its artistic side, home decoration has now become a practical art requiring systematic training on the part of those by whom it is practised, and having secured for itself general public recognition as distinct from architecture or mere trade activity in the supply of the articles necessary for the home.

With the growth of civilization the decoration of the home, be it a hut, cave, cottage, or palace, has always appealed directly to its owner or occupants, and their taste has found expression in combining beauty with utility. As a result there is to be seen decorative activity ranging from a most humble scale to securing the work of the greatest artists of the period for ornamental purposes. It is only recently that the proper and most advantageous uses of articles of decorative value have been recognized, and with the growth of luxury and comfort there has been, on the whole, a corresponding growth in good taste. In large part, this has been due either to artist, craftsmen of rare talents or to those who have studied the various æsthetic elements involved in house decoration, recognizing the cardinal principle that a home is designed for habitability. From such study encouraged by museums and collections there has grown up a school of decorative art known as interior decoration, which aims to cultivate public taste to appreciate the artistic and to make the home conform to the accepted canons of good taste, where the work not only of artists but of skilful craftsmen and artisans will be appreciated.

This movement involves both a general manifestation of progressively better taste and the activities of those trained professionally in schools of fine arts or design to practice the art of interior decoration and to advise persons who need such assistance. Just as the ordinary person requires the service of an architect to design or remodel a house or apartment, so when its decoration and furnishing are involved there is no less a call for the services of a trained interior decorator, rather than a mere painter, upholsterer or tradesman. To this profession many women, as well as men, are now devoting themselves with marked success, and to learn of their training and their work one can turn to the article on INTERIOR DECORATION. Here will be found, also, a broad view of the development and scope of the modern art, and if read in connection with the more formal article on DECORATIVE ART, with attention also to ORNAMENT and ARCHITECTURE, a good idea will be gained of the modern status of this important field. Naturally, there are subsidiary to it a number of subordinate articles—thus, FURNITURE is an important part of Interior Decoration, and in its development may be traced the

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general progress of the beautiful with the practical, though retrogression in taste unquestionably is to be noted with the increase of mechanical facility in production and otherwise. Likewise, in CARPETS and RUGS decorative impulse finds expression, and floor coverings represent a wide diversity of artistic ideas, depending upon their service, from the hand looms of the Orient to the modern carpet factory. Again, in the decoration of the surfaces of walls from the older tapestries to the WALL PAPER of the day, a distinct artistic development is represented. In TEXTILE PRINTING also modern art has brought about a wide range of decorative material for the modest householder.

Therefore, with the citation of such main titles, a consideration of a somewhat fuller list will show the interrelation of the articles in this and allied departments, and how advantageously they fit into a comprehensive reading scheme. The list might be taken up in the following order:

Interior Decoration	Veneer
Decorative Art	Wall Paper
Ornament	Paper Hanging
Architecture	Textile Printing
Mural Decoration	Tapestry
Painting	Gobelin
Sculpture	Carpet
Illumination	Rug
Furniture	Lamp
Chippendale Chairs	Lacquer Work
Chippendale, Thomas	Pottery
Hepplewhite, George	Armor
Sheraton, Thomas	Metal Work
Boulle	

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# Chapter 18. Geology

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**G**EOLGY covers a broad field. Its primary object is to explain the origin and development of the earth and the inhabiting life forms. It is concerned thus on the one side with inorganic nature—the character of the materials which constitute the earth's structure, the formation and classification of rocks, the forces of uplift that have produced mountains and continental lands, the agencies that work to modify surface features, the phenomena of earthquakes and volcanoes, and all processes of change operative from the beginning; in another aspect it is allied to the biologic sciences for which it endeavors to find an explanation for the present distribution of plants and animals in the evidences afforded by fossils which have been preserved in the superficial layers of the earth.

Because of its wide scope, geological science has been separated into a number of departments, each with its distinct formations, but none the less closely related to all the others. Of fundamental importance is Petrology, the branch which considers the nature of rocks and the methods of their origin. This branch is one of the last to have attained a real scientific basis. The arrangement of the rocks as they appear at the surface—often quite different from their original attitudes—and the significance of the arrangement in relation to past events, constitute the subject matter of Structural Geology. The great changes which have taken place and are still in progress belong to the field of Dynamical Geology, which considers the action of the atmosphere, water, igneous activity and crustal strains in modifying the earth's features. Its study is essential to the proper understanding of physical geography, particularly the modern development of that subject known as physiography. Consequently the references to physiographic articles will be included under its head. Stratigraphical Geology has for its particular province the investigations of the order and chronological classification of the strata and the study of the geography of the earth in past ages. It has a valuable adjunct in Paleontology, which is the study of fossils and their interpretation in the light of evolution. Geology has many practical bearings, and its application to mining, agriculture and engineering is considered under the head of Economic Geology.

We shall now guide the reader to the articles relating to those several divisions of the subject. For the general article, see GEOLOGY.

## A. Petrology

For the more comprehensive articles in this field, see:

Petrology  
Mineralogy

Crystallography  
Rock

The various large groups or classes of rocks are described under the following titles:

Igneous Rocks  
 Aqueous Rocks  
 Æolian Accumulations  
 Clastic Rocks  
 Plutonic Rocks  
 Metamorphic Rocks  
 Crystalline Rocks  
 Arenaceous Rocks  
 Argillaceous Rocks  
 Calcareous Rocks

For the more important specific kinds of rocks, see:

### 1. IGNEOUS (MASSIVE) ROCKS:

Granite  
 Rhyolite  
 Porphyry  
 Syenite  
 Trachyte  
 Phonolite  
 Diorite  
 Dacite  
 Felsite  
 Gabbro  
 Pyroxenite  
 Hornblendite  
 Peridotite  
 Diabase  
 Basalt  
 Melaphyre  
 Felsite  
 Trap  
 Obsidian  
 Pitchstone  
 Lava  
 Tuff

### 2. SEDIMENTARY (STRATIFIED) ROCKS.

#### (a) *Mechanical Sediments:*

Sand  
 Gravel  
 Sandstone

Conglomerate  
 Breccia  
 Clay  
 Shale  
 Silt  
 Loess  
 Boulder Clay  
 Drift

#### (b) *Chemical Sediments:*

Limestone  
 Dolomite  
 Travertine  
 Gypsum  
 Salt  
 Geyserite  
 Bog-Iron Ore  
 Clay Ironstone

#### (c) *Organic Sediments:*

Limestone  
 Coquina  
 Chalk  
 Coral  
 Marl  
 Diatomaceous Earth  
 Phosphate Rock  
 Peat  
 Lignite  
 Coal

### 3. METAMORPHIC (FOLIATED) ROCKS:

Marble  
 Quartzite  
 Slate  
 Schist  
 Gneiss  
 Amphibolite  
 Mica Schist  
 Eclogite  
 Serpentine  
 Talc  
 Soapstone  
 Chlorite Schist

## B. Structural Geology

The broader features of geological structure are described in the articles:

Bed  
Formation  
Conformity  
Unconformity  
Laccolite  
Batholite  
Boss  
Dike  
Sill  
Veins

The smaller elements of structure which pertain to the above larger forms are explained in the articles:

Joints

Foliation  
Lamination  
Schistosity  
Stratification

The effects of uplift and disturbance upon rocks are described in the articles:

Continent  
Mountain  
Anticline  
Syncline  
Monocline  
Dip  
Strike  
Fault  
Clinometer

## C. Dynamic Geology and Physiography

The general subject of dynamic agencies operative within the earth is discussed in the articles:

Crust of the Earth  
Elevation and Subsidence  
Metamorphism  
Cataclysm  
Volcano  
Earthquake  
Geyser  
Refrigeration of the Earth

For the evolution of the topography of the earth's surface, see:

Physiography  
Erosion  
Continent  
Island  
River  
Valley  
Plateau  
Lake  
Glacier  
Glacial Period

## D. Stratigraphical Geology

The rocks composing the outer solid structure of the earth are separated according to their position and relative age into large divisions which are

designated as groups. Each group represents a long interval of time or era during which the strata were accumulated. The different groups and

their corresponding eras are described under:

Archeozoic Era  
 Proterozoic Era  
 Paleozoic  
 Mesozoic Era  
 Cenozoic

These main divisions are further subdivided into systems, or, according to the time element, into periods. The several systems are described in the following articles:

1. *Archeozoic and Proterozoic:*

Pre-Cambrian Formations

2. *Paleozoic:*

Cambrian System  
 Ordovician  
 Silurian System  
 Devonian System  
 Carboniferous System  
 Permian System

3. *Mesozoic:*

Triassic System  
 Jurassic System  
 Cretaceous System

4. *Cenozoic:*

Tertiary System  
 Quaternary System

The broader scheme of classification as outlined above is of general application. Further subdivision becomes necessary in the study of particular areas, for the individual strata change in character and often in fossil content, as they are traced from place to place. To identify the minor units, geologists usually employ local names

which have currency only within a single country or among such countries as have very similar stratigraphic development. Some of the more important minor divisions in the United States are described in the articles:

*Pre-Cambrian:*

Keweenaw Series

*Cambrian:*

Potsdam Sandstone

*Ordovician:*

Calciferous  
 Trenton  
 Hudson River Beds

*Silurian:*

Medina Series  
 Clinton Stage  
 Niagara Series  
 Salina Stage

*Devonian:*

Oriskany  
 Lower Helderberg  
 Chemung Formation  
 Catskill Formation

*Carboniferous:*

Millstone Grit  
 Pottsville Conglomerate  
 Burlington Limestone

*Triassic:*

Newark Series

*Jurassic:*

Liassic  
 Oolite

*Cretaceous:*

Potomac Formation  
 Dakota Stage  
 Niobrara Stage  
 Laramie Stage

*Tertiary:*

Eocene Epoch  
Oligocene Epoch  
Miocene Epoch  
Pliocene Epoch

*Quaternary:*

Columbia Series  
Drift  
Glacial Period  
Recent Period

## *E. Paleontological Geology*

Paleontology is the study of the nature and distribution of the life forms imbedded in the rocks of the earth's crust. Viewed from the standpoint of biological science, it is a part of zoology and botany; but it is so intimately connected with the study of the rocks themselves that it may properly be considered a part of geology. The general articles on the subject are:

Paleontology  
Paleobotany  
Fossil  
Fossiliferous Rocks  
Contemporaneity  
Homotaxy  
Ichnology  
Fossil Forests

From a biological point of view, the proper method of classifying fossil forms would naturally follow the same principles that guide the classification of living plants and animals. But in studying paleontology as a part of geology, the geological classification is preferable; indeed, the two systems would, to a certain extent, coincide. We shall, therefore, refer the reader to the characteristic fossils of each geological epoch. Most of the larger classes and orders of fossil forms are still represented by living species, and general discussions of these classes

will be found in the articles given in the chapters on Botany and Zoology.

1. The only fossils found in the Pre-Cambrian Formation are described in the article *ANTIPOKANIA*:

### 2. CAMBRIAN FOSSILS:

#### (a) *Plants*:

Oldhamia

#### (b) *Animals*:

Protospongia  
Dictyonema  
Agnostus  
Paradoxides  
Dikellocephalus  
Olenellus  
Trilobita  
Lingula  
Obolella  
Hyolithes  
Nautiloidea

### 3. ORDOVICIAN AND SILURIAN FOSSILS:

#### (a) *Invertebrates*:

Brachiospongia  
Stromatopora  
Graptolite  
Monograptus  
Favosites  
Olenus  
Chonetes  
Asaphus  
Polyzoa



Fenestella  
Atrypa  
Orthis  
Spirifer  
Pentamerus  
Bellerophon  
Pteropoda  
Orthoceras  
Tentaculites  
Eurypterus

(b) *Fishes*:

Pteraspis  
Cyathaspis

4. DEVONIAN FOSSILS:

(a) *Invertebrates*:

Atrypa  
Cyathophyllum  
Phacops  
Ammonoidea  
Pleurotomaria  
Murchisonia  
Clymenia  
Goniatites  
Bactrites  
Heliophyllum

(b) *Fishes*:

Holoptychius  
Osteolepis  
Dipterus  
Coccosteus  
Dinichthys  
Cephalaspis  
Chirolepis

5. CARBONIFEROUS FOSSILS:

(a) *Plants*:

Neuropteris  
Calamites  
Asterophyllites  
Annularia

Lepidodendron  
Sigillaria  
Stigmaria  
Cordaite  
Carpolith  
Trigonocarpus

(b) *Invertebrates*:

Fusulina  
Chonetes  
Productus  
Proetus  
Eurypterus

(c) *Fishes*:

Megalichthys  
Cestraciont

(d) *Reptiles*:

Stegocephalia

6. PERMIAN FOSSILS:

(a) *Fishes*:

Palæoniscus

(b) *Reptiles*:

Rhynchocephalia

7. TRIASSIC FOSSILS:

(a) *Plants*:

Equisetum  
Cycadaceæ

(b) *Invertebrates*:

Terebratula  
Ceratites  
Ammonites

(c) *Reptiles*:

Mastodonsaurus  
Theromorpha  
Dinosauria  
Anchisaurus  
Labyrinthodon  
Dicynodon

- (d) *Mammals*:  
Microlestes  
Microconodon
8. JURASSIC FOSSILS:
- (a) *Invertebrates*:  
Gryphæa  
Trigonia  
Belemnites
- (b) *Fishes*:  
Chondrosteus  
Hybodus
- (c) *Reptiles*:  
Teleosaurus  
Ichthyosaurus  
Plesiosaurus  
Pterodactyl  
Dimorphodon  
Diplodocus  
Megalosaurus  
Brontosaurus  
Stegosaurus  
Titanosaurus  
Cynognathus  
Baptanodon  
Camptosaurus  
Ceratosaurus
- (d) *Birds*:  
Archæopteryx
- (e) *Mammals*:  
Ctenacodon
9. CRETACEOUS FOSSILS:
- (a) *Invertebrates*:  
Foraminifera  
Globigerina  
Ventriculites  
Hippurites  
Radiolites  
Inoceramus
- (b) *Reptiles*:  
Chelonia
- Iguanodon  
Mosasauria  
Elasmosaurus  
Hadrosaurus
- (c) *Birds*:  
Bird, Fossil  
Hesperornis  
Ichthyornis
10. EOCENE FOSSILS:
- (a) *Invertebrates*:  
Nummulites
- (b) *Reptiles*:  
Zeuglodon
- (c) *Mammals*:  
Coryphodon  
Hyracotherium  
Horse, Fossil  
Palæotherium  
Anchitherium  
Anoplotherium  
Lophiodon  
Creodonta
11. MIOCENE FOSSILS:
- (a) *Mammals*:  
Mastodon  
Dinotherium  
Helladotherium  
Machærodus  
Elotherium  
Halitherium  
Hyracodon  
Oreodon  
Titanotherium
12. PLOocene FOSSILS:
- (a) *Plant*:  
Dæmonelix
- (b) *Mammals*:  
Sivatherium

Hipparion  
Sabre-Toothed Tiger

### 13. QUATERNARY FOSSILS:

#### (a) *Birds:*

Æpyornis  
Moa

#### (b) *Mammals:*

Elasmotherium  
Megatherium  
Glyptodon  
Diprotodon  
Mammoth  
Mastodon  
Pithecanthropus

## F. Economic Geology

This department considers the application of geological facts and principles to industry and technology. The service of geology to mining is especially important and has been recognized very generally by the organization of public surveys to furnish information about the occurrence and distribution of the mineral resources. With this function is usually combined the study of underground waters, a branch that has gained prominence quite recently through the development of the arid tracts of the western United States. Geology also affords useful guidance in the conduct of engineering construction, and of course is the basis for the investigation of the formation and distribution of soils.

The mineral materials that find employment in the arts or industry are of great variety and exhibit wide differences in their methods of occurrence. Some are used in the form in which they exist in nature, or require only a mechanical process of purification or preparation. Such are exemplified by building stones and coal. A large class of minerals, however, have no value in their natural state, but contain valuable elements that can only be released by some metallurgical or chemical treatment. They are illus-

trated by the compounds containing metals, which in their natural state are called ores. The mode of occurrence of the ores, as well as of the non-metalliferous minerals, is the proper field of study of Economic Geology, while the methods employed in their production belong to Mining and Metallurgy.

I. The forms and occurrence of the larger rock masses have already been referred to under Petrology and Structural Geology. The other non-metallic substances will be described in the articles on each specific substance. It is, therefore, only necessary to give as introductory articles those descriptive of the occurrence of the ores. See:

Ore  
Ore Deposits  
Gangue  
Footwall  
Hanging Wall  
Pinch  
Dike  
Vein  
Lode

### II. THE METALLIFEROUS ORES:

#### 1. *Iron Ores:*

Limonite  
Hematite  
Magnetite

Siderite  
Franklinite  
Bog-Iron Ore  
Blackband Ironstone  
Pyrite  
Pea Ore

2. *Gold Ores:*

Gold  
Calaverite  
Hessite

3. *Platinum*

4. *Silver Ores:*

Silver  
Argentite  
Pyrargyrite  
Cerargyrite  
Proustite  
Stephanite

5. *Copper Ores:*

Chalcopyrite  
Cuprite  
Malachite

6. *Lead Ores:*

Galena  
Anglesite  
Cerusite  
Pyromorphite

7. *Zinc Ores:*

Blende  
Willemite  
Zincite  
Franklinite  
Smithsonite  
Calamine

8. *Mercury Ores:*

Cinnabar  
Calomel

9. *Manganese Ores:*

Pyrolusite

Manganite  
Psilomelane

10. *Aluminum Ores:*

Cryolite  
Gibbsite  
Bauxite

11. *Tin Ore:*

Cassiterite

12. *Nickel Ores:*

Millerite  
Pyrrhotite

13. *Antimony Ore:*

Stibnite

III. THE CARBON MINERALS:

1. Coal

Anthracite  
Bituminous Coal  
Jet  
Lignite  
Torbanite  
Peat

2. Petroleum

Gas, Natural

3. Asphalt

Bitumen  
Albertite  
Grahamite  
Gilsonite  
Maltha

4. Ozocerite

Asphaltic Coal  
Mineral Tallow

5. Graphite

IV. BUILDING MATERIALS:

Building Stone

Granite

Sandstone

Limestone  
Freestone  
Marble  
Onyx Marble  
Flagstone  
Caithness Flagstone  
Slate  
Bath Stone  
Caen Stone  
Brownstone  
Puzzuolana

V. SOILS, CLAYS, FERTILIZERS, AND  
WATERS:

1. Humus  
Soil  
Loam  
Loess
2. Clay  
Potters' Clay  
Fire Clay  
Pipe Clay  
Brick Clay  
Kaolin
3. Gypsum  
Apatite  
Phosphorite  
Marl  
Guano
4. Mineral Waters  
Spring  
Artesian Wells

VI. SALTS:

Salt  
Bay Salt  
Borax  
Bromine  
Iodine

VII. PRECIOUS STONES:

Diamond

Corundum  
Quartz  
Emerald  
Ruby  
Beryl  
Chrysoberyl  
Sapphire  
Aquamarine  
Tourmaline  
Spodumene  
Amethyst  
Opal  
Alabaster  
Chalcedony  
Carnelian  
Sardonyx  
Aragonite  
Agate  
Jasper  
Chrysolite  
Turquoise  
Topaz  
Garnet  
Rhodonite  
Chrysocolla  
Catlinite  
Benitoite  
Smithsonite

VIII. ABRASIVES:

Abrasives  
Diamond  
Grindstone  
Buhrstone  
Oil-Stone  
Novaculite  
Emery  
Corundum  
Carborundum  
Garnet  
Diatomaceous Earth  
Tripolite  
Pumice

**IX. PIGMENTS:**

Mineral Paints  
 Graphite  
 Ochre  
 Umber  
 Burnt Sienna  
 Chalk  
 Hematite  
 Slate

**X. MINERALS USED IN VARIOUS ARTS:**

Lithographic Stone

Solenhofen Lithographic Stone

Talc  
 Soapstone  
 Mica  
 Feldspar  
 Fluorite  
 Sulphur  
 Asbestic  
 Asbestos  
 Magnesite  
 Fuller's Earth  
 Monazite

## G. Biographies of Eminent Geologists

Barrande, J.  
 Beyrich, H. E. B.  
 Bishop, K. G.  
 Brongniart, A.  
 Buch, L. von  
 Buckland, W.  
 Chamberlin, T. C.  
 Conybeare, W. D.  
 Cope, E. D.  
 Cotta, B. von  
 Dana, J. D.  
 Darwin, Charles  
 Daubrée, G. A.  
 Dawson, Sir J. W.  
 De la Beche, Sir H. T.  
 Elie de Beaumont, J. B.  
 Eichwald, K. E.  
 Emmons, E.  
 Forbes, J. D.  
 Gaudry, A.  
 Geer, G. de  
 Geikie, Sir Archibald  
 Goldfuss, G. A.  
 Hall, Sir James  
 Hall, James  
 Hayden, F. V.  
 Heer, O.  
 Heim, A.

Hitchcock, E.  
 Humboldt, F. H. A. von  
 Hutton, J.  
 Koninck, L. G.  
 Lapparent, A. A. C. de  
 Lea, I.  
 Le Conte, J.  
 Logan, Sir William  
 Lyell, Sir Charles  
 Marcou, J.  
 Marsh, O. C.  
 Miller, H.  
 Mojsisovics, E. von  
 Murchison, Sir R. I.  
 Newberry, J. S.  
 Orbigny, A. D. d'  
 Owen, Sir R.  
 Phillips, J.  
 Playfair John  
 Powell, J. W.  
 Prestwich, Sir Joseph  
 Ramsay, Sir A. C.  
 Roemer, F. A.  
 Rosenbusch, H.  
 Saussure, H. B. de  
 Schimper, W. P.  
 Sedgwick, A.  
 Silliman, B.

Smith, W.

Sowerby, J.

Strickland, H. E.

Suess, Eduard

Unger, F.

Werner, A. G.

Winchell, A.

Woodward, S. P.

Zittel, K. A. von

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# Chapter 23. Meteorology

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**M**ETEOROLOGY is the study of the atmosphere, its static conditions and appearances, and the changes and movements of all kinds which take place in it. The two principal constituents of the atmosphere are the air and the moisture in various forms which the air holds in suspension. Weather and climate are principally determined by the conditions under which these two constituents exist, at any particular time or habitually. The static conditions of the air which mainly affect the weather are its temperature and its pressure; its movements come under the general term wind. The moisture of the atmosphere, unlike the bulk of the air, is continually changing its identity. It is raised from surface waters by evaporation, held for a time in suspension under various forms, and then returned to the earth's surface by various modes of precipitation.

Besides these two sets of phenomena, the electrical conditions of the atmosphere form an important element of the weather. Other causes sometimes bring about peculiar or unusual weather conditions, and, aside from weather in its strict sense, meteorology takes cognizance of the peculiar optical appearances which the atmosphere presents. These considerations, together with the fact that the practical aspects and practical rather than theoretical investigations hold, perhaps, a more prominent place in meteorology than in other natural sciences, serve to indicate the main divisions of the subject. A considerable number of instruments are used in meteorological investigations, and the articles describing these will be referred to in connection with the appropriate subdivision.

## I. GENERAL PRINCIPLES OF THE SCIENCE. See:

Meteorology  
Atmosphere  
Polarization of Sky Light  
Dust  
Climate  
Weather

## II. TEMPERATURE AND PRESSURE.

1. The theory and investigation of temperature and its causes are treated under:

Temperature, Terrestrial  
Cold Wave  
Frost  
Snow Line  
Actinometry  
Thermometry  
Seasons

2. The instruments used in measuring temperature and radiation are described under:

Thermometer  
Actinometer  
Actinograph  
Radiometer  
Pyreheliometer

3. For atmospheric pressure and the instruments used in measuring it, see:

Barometer

## III. WINDS.

1. There are certain general forms of wind movements recognized without reference to localities. See:

Wind  
Storm  
Whirlwind



Tornado

Waterspout

Gale

2. On the other hand, in certain parts of the world peculiar local conditions produce winds which have received local names. See:

Doldrums

Calm Latitudes

Blizzard

Chinook

Etesian Winds

Harmattan

Hurricane

Mistral

Sirocco

Monsoon

Simoom

Equinoctial Storm

3. For the instruments and methods used in measuring or observing the winds, see:

Anemometer

Anemograph

Anemoscope

Beaufort Scale

#### IV. EVAPORATION AND PRECIPITATION.

1. See the general article:

Evaporation

2. The various forms in which moisture is held suspended are described under:

Humidity

Haze

Fog

Cloud

3. For the various forms of precipitation, see:

Dew

Hoar Frost (under Frost)

Rain

Cloudburst

Snow

Hail

4. For the instruments used in measuring or observing the moisture of the atmosphere, see:

Hygrometer

Drosometer

Nephoscope

Rain Gauge

#### V. ELECTRICAL CONDITIONS AFFECTING THE WEATHER. See:

Atmospheric Electricity

Lightning

Lightning, Accidents from

Lightning, Protection from

#### VI. PECULIAR OR UNUSUAL WEATHER CONDITIONS ARE DESCRIBED IN THE ARTICLES:

Dust

Dark Day

Black Rain

Blood-Rain

Indian Summer

#### VII. OTHER PHENOMENA OF THE ATMOSPHERE BELONG MAINLY TO OPTICAL APPEARANCES OR ELECTRICAL DISPLAYS. See:

Rainbow

Fog-Bow

Halo

Scintillation

Mirage

Fata Morgana

Aurora Borealis

Elmo's Fire, Saint

Castor and Pollux

#### VIII. PRACTICAL INVESTIGATIONS IN METEOROLOGY ARE GENERALLY CONDUCTED BY GOVERNMENT BUREAUS. See:

Weather Bureau

Signal Corps, U. S. Army

These bureaus warn the public by a system of signals. See:

Storm and Weather Signals

And in this connection also:

Fog Signals

They also issue daily weather maps.

See:

Isothermal Lines

Isobarometric Lines

Isograms

Isabnormal Lines

Isanomalous Lines

**IX. FOR BIOGRAPHIES OF THE MOST  
PROMINENT METEOROLOGISTS, see:**

Abbe, Cleveland

Espy, James Pollard

Fonvielle, Wilfrid de

Maury, M. F.

Pernter, J. M.

Wild, H.

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# Chapter 24. Geography

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**G**EOGRAPHY is the description of the surface of the earth in all its aspects. Just as the place where the atmosphere is where the lithosphere meets the hydrosphere, so do the sciences of METEOROLOGY and GEOLOGY meet in that of GEOGRAPHY, and the last to a certain extent encroaches upon the fields of the other two. The subject is very wide, covering a regional study of the upper layers of the earth's crust, a regional study of the atmosphere, or the climatic conditions prevailing on the various parts of the surface. Thus, in the consideration of any region on the earth, we should study the character of the land configurations, the bodies of water (rivers, lakes, seas, etc.) and their influences, the flora and fauna and their relationship to the other physical features, and, finally, the human inhabitants, their character and activities. Of course, we should also consider region as a whole and its relationship to other parts of the earth.

The whole subject may be broadly divided into three main branches: Mathematical Geography, which deals with the form, dimensions, and position of the earth, and the methods of its delineation; Physical Geography, which is a general discussion of the various natural features of the earth's surface, and Political, Regional, or Descriptive Geography, which gives detailed and specific descriptions of the separate parts of the earth's surface, generally as its human inhabitants have divided it among themselves, all their varied activities, and all the artificial changes which they have made, and the structures which they have built.

## A. Mathematical Geography

### I. GENERAL. See:

Earth  
Pole  
Equator, Terrestrial  
Meridian  
Latitude and Longitude  
Degree of Latitude  
Degree of Longitude  
Tropics  
Geography  
Zone

Globe  
Coast and Geodetic Survey  
Geodesy  
Surveying

### II. METHODS OF DELINEATION. See:

Map  
Chart

### III. TERRESTRIAL MAGNETISM. See:

Magnetism, Terrestrial  
Declination  
Dip  
Isoclinic  
Isogonic Lines  
Isodynamic Lines  
Compass  
Theodolite  
Sextant

## B. Physical Geography

Under this head will be given the articles dealing with geographical features that are due to various geological or climatic causes. The articles on the causes themselves are referred to under Geology and Meteorology. At the end of each subdivision are given the articles on the most remarkable examples of the features discussed. In connection with this section the departments of Zoölogy and Botany should also be consulted.

### I. GENERAL ARTICLE. See:

Physiography

### II. OCEANOGRAPHY:

Oceanography  
Ocean  
Deep-Sea Exploration  
Sounding  
Abysmal Accumulations  
Oceanic Deposits  
Ocean Currents  
Tides  
Bore  
Channel  
Shore  
Gulf Stream  
Atlantic Ocean  
Pacific Ocean  
Indian Ocean

### III. GENERAL LAND FORMS:

Aiguille  
Archipelago  
Butte  
Cordillera  
Continent  
Island  
Isthmus  
Mountain  
Valley

Plateau  
Sierra  
Basin  
North America  
Australia  
Himalaya  
Malay Archipelago  
Panama, Isthmus of  
Sierra Nevada

### IV. HYDROGRAPHY:

Hydrography  
Bayou  
Bog  
River  
Divide  
Waterfall  
Inundation  
Flood Plain  
Delta  
Reef  
Bar  
Lake  
Floating Island  
Mississippi River  
Amazon River  
Nile  
Great Lakes

### V. GEOGRAPHICAL FEATURES DUE TO MOVEMENTS OF THE EARTH'S CRUST:

Beaches, Raised  
Earthquake  
Estuary  
Fiord  
Coastal Plain  
Great Rift Valley

### VI. FEATURES DUE TO VOLCANIC AC- TION:

Volcano  
Crater

Geyser  
Dike  
Laccolite  
Vesuvius  
Etna (Ætna)  
Krakatoa  
Pelée, Mont  
Hecla  
Mauna Loa  
Kilauea  
Soufrière, La  
Popocatepetl  
Yellowstone National Park  
Palisades  
Giant's Causeway  
Staffa

#### VII. FEATURES DUE TO EROSION:

Erosion  
Piedmont Plain  
Bad Lands  
Cliff  
Talus  
River Terraces (under Terrace)  
Cañon  
Mesa  
Sink Hole  
Cave  
Karst  
Delaware Water Gap  
Colorado River  
Niagara River and Falls  
Victoria Falls  
Mammoth Cave  
Luray Cave  
Natural Bridge  
Yosemite Valley

#### VIII. FEATURES DUE TO GLACIAL ACTION:

Glacier  
Moraine  
Iceberg (under Ice)  
Avalanche  
Drumlin  
Eskers  
Giants' Kettles  
Rocking Stones  
Mer de Glace  
Gorner Glacier

#### IX. FEATURES DUE TO WIND ACTION:

Dune  
Medano  
Musical Sand

#### X. FEATURES DUE TO PECULIAR SOIL OR CLIMATIC CONDITIONS:

Desert  
Oasis  
Prairie  
Savannas  
Steppe  
Tundra  
Downs  
Llanos  
Pampas  
Karoo  
Sahara  
Gobi

#### XI. FEATURES DUE TO THE ACTION OF ANIMALS:

Coral Island  
Atoll  
Barrier Reef

## C. Political or Regional Geography

This is by far the most important part of geographical study, and, taken as a whole, is probably the largest and most valuable department of the New INTERNATIONAL ENCYCLOPEDIA. Lack

of space makes it impracticable to enumerate all of the important articles in the work connected with a study of Political Geography. The next best thing would be an outline of geograph-

ical history and knowledge, which would of itself suggest further fields of investigation.

The earliest geographic knowledge dates back to about 600 B. C. Hecataeus was one of the first cartographers, and at about 500 B. C. made a map of the world as known then, showing the existence of two continents. Herodotus distinguished three continents, Aristotle demonstrated that the world was round, and Eratosthenes computed the length of the earth's circumference to be 25,000 miles. Ptolemy extended the knowledge of the world by a vast amount and drew maps that were used by Columbus over thirteen centuries later.

In the line of exploration, the Phœnicians were the first nation of discoverers. With the Carthaginians and the Egyptians their trading brought them into many unknown regions, which they frequently colonized. The Arabs contributed a large amount of geographic knowledge during the Middle Ages and the Norsemen colonized Iceland and Greenland and explored the northern seas.

The names connected with geographical knowledge up to the fifteenth century, when the period of modern explorations began, are in the following list:

#### I. ANCIENT:

Hecataeus of Miletus  
Herodotus  
Eratosthenes  
Pythagoras  
Ptolemy  
Aristotle  
Strabo  
Tyre  
Pytheas of Marseilles

Alexander the Great  
Masudi  
Edrisi  
Ibn Batuta  
Ericson, Lief  
Benjamin of Tudela

#### II. MEDIEVAL:

Rubruquis  
Polo, Marco  
Clavijo  
Conti, Niccolò dei

Modern exploration dates from the fifteenth century, particularly from the time of Prince Henry of Portugal. The discovery of the Cape of Good Hope and the utilization of the magnetic compass lent impetus to the navigation of the high seas and consequent discoveries. These were at first confined to Africa, in a search for an all-water route to India. Then came Columbus, who discovered the West Indies (America). This marked the beginning of a series of discoveries that resulted in the uncovering of the entire Western Hemisphere and the establishment of the main features of the globe on both land and sea. With this accomplished, the attention of the world turned to the opening up and development of the newly discovered lands. North and South America, Africa, Asia, Australia, and many of the Pacific Islands were all fields of endeavor in the search for growth of trade and wealth. Many places were discovered and explored by men of different countries and disputes frequently arose over their possession. All of the maritime nations, particularly Portugal and Spain, took part, the names of hundreds of men finding their way into the annals of history.

In the following list are men prominent in early exploration and discovery. The names will suggest articles on the regions explored and other places affected.

Men and places involved in early discovery and exploration:

#### I. SOUTH AMERICA:

Pizarro, Francisco  
Drake, Sir Francis  
Hawkins, Sir Richard  
Magalhães, Fernão de

#### II. NORTH AMERICA:

Columbus, Christopher  
Vespucius, Americus  
Cabot, John  
Cabot, Sebastian  
Balboa, Vasco Nuñez de  
Cortés, Hernán  
Soto, Hernando de  
Cartier, Jacques

#### III. AFRICA:

Cadamosto  
Días de Novæ, Bartholomeu  
Gama, Vasco da  
Henry the Navigator

#### IV. SOUTH SEA AND PACIFIC OCEAN:

Tasman, Abel Janszoon  
Cook, Capt. James  
Entrecasteaux, Joseph Antoine  
Bruni, Chevalier d'

Exploration in Africa, at first entirely confined to the Portuguese, became the attention of other nations toward the end of the 18th century, when James Bruce, an Englishman, seeking the source of the Nile, discovered the Blue Nile. He heads a very long list of African explorers, more prominent among whom are Mungo Park, Heinrich Barth, David Living-

stone, H. M. Stanley, Gerhard Rohlfs. There are still parts of this continent, South America and Asia, which are quite unknown. These are slowly being uncovered by men who are accomplishing difficult and arduous tasks with little or no glory.

The main attention of the world in modern times has been directed toward the explorations of the Polar Regions. At first actuated by purely commercial incentives, the efforts of explorers today are directed in the interest of science. The earliest explorations in the North Polar regions, however, were caused by the search for the Northwest Passage to the Orient. The men prominently connected with this in particular were the Cabots, Henry Hudson, Parry, Cook, Rae, Simpson, Franklin and McClure. The Antarctic has received less attention than the northern fields on account of its remoteness, and it is only recently that any valuable work has been done there. In this connection Shackleton, Scott and Amundsen stand out prominently among the few South Polar explorers.

Recent successes in the Polar Regions are directly attributable to the lessons learned in early work there and to the advance in scientific knowledge, which gave to the men advantages never had by early explorers. Both Poles have finally been attained, the North Pole by Peary (April 6, 1909), and the South Pole by Amundsen (December 4, 1911) and Scott (January 18, 1912). See articles POLAR RESEARCH, NORTHWEST PASSAGE.

POLAR EXPLORERS. See:

Amundsen, R.  
Back, G.

Baffin, W.  
 Barents, W.  
 Bering, V.  
 Cook, J.  
 Franklin, J.  
 Greely, A. W.  
 Hudson, H.  
 Kotzebue, O. von  
 McClure, R. J. le M.  
 Mawson, D.  
 Nansen, E.  
 Nordenskiöld, N. A.  
 Parry, W. E.  
 Payer, S.  
 Peary, R. E.  
 Ross, J. C.  
 Ross, J.  
 Scott, R. F.  
 Shackleton, E. H.  
 Stefansson, V.  
 Sverdrup, O.  
 Vancouver, G.  
 Vilkitsky, B. A.  
 Wellman, W.  
 Weyprecht, K.  
 Wilkes, C.

Lack of space forbids anything like an enumeration of even the more important articles describing the various parts of the earth and their inhabitants. The bulk of minor gazetteer articles are intended only for incidental reference, when information about a particular locality is desired. Nevertheless, it would be possible to plan a very instructive and interesting course of systematic reading in descriptive geography.

One way would obviously be to read first the articles on the larger divisions of the earth, EUROPE, ASIA, AFRICA, AMERICA, AUSTRALIA, ARCTIC REGION, and ANTARCTIC REGION, and, in the latter connection, the article on

POLAR RESEARCH. These articles give, besides, a general geographic and ethnographic description, and a history of exploration and discoveries from ancient to recent times. They also refer to the separate divisions of the larger land areas, and, by reference to the articles on these divisions, the reader will be carried successively into narrower and narrower fields with more and more detailed description.

The story of explorations and discoveries, and of the science of geography, may also be carried further by means of the following names and titles:

Andrée, S. A.  
 Baker, S. W.  
 Barth, H.  
 Behaim, M.  
 Borchgrevink, C. E.  
 Brazza, P.  
 Burckhardt, J. L.  
 Burton, R. F.  
 Chancellor, R.  
 Flinders, M.  
 Gray, R.  
 Hakluyt, R.  
 Hedin, Sven  
 Johnston, H. H.  
 Kane, E. K.  
 Kiepert, H.  
 Kingsley, M. H.  
 Kohl, J. G.  
 La Hontan, A. L.  
 Lander, R. L.  
 Lapérouse, J. F.  
 Lockwood, J. B.  
 Major, R. H.  
 Malte-Brun, K.  
 Markham, C. R.  
 Przhevalski, N. M.  
 Ratzel, F.  
 Ravenstein, E. G.



Reclus, E.  
Rennel, J.  
Ritter, K.  
Speke, J. H.  
Sturt, C.

Still an other method of carrying on the study of geography would be to study the maps, and, wherever a particular region found there excites the reader's curiosity, turn to the appropriate article. Many other ways will suggest themselves, according to the individual's tastes, inclination, or requirements, and it will be found that an encyclopædia is the best means of gaining, not only a minute knowledge of any particular locality on the earth's

surface, but also a broad perspective view of the whole field of human activity. For the gazetteer articles are not to be regarded merely as dealing with topics in geography. Taking any of the articles on the various countries of the globe, as the UNITED STATES, or JAPAN, such article may be made to supply detailed information on whatever topic may be the subject of study or reading: Zoölogy, Geology, Statistics, Finance, Education, Industry, or Transportation. To quote these articles and the accompanying maps would be to encumber the book with enormous lists of names, which the reader may be trusted readily to select for himself.

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## Chapter 25. Botany

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**B**OTANY is the science that deals with plants in all their aspects,—their origin and development, nature, structure, life processes, classification, and distribution. The nature and origin of plants will be discussed in the general articles given below. All considerations of the form and structure of individual plants may be broadly classed under the general term Structural Botany, or Plant Anatomy. The study of the processes which constitute the life of a plant and the conditions which affect those processes is called Physiology. These two branches of the science are sometimes united under the term General Botany, as distinct from Specific or Systematic Botany, also called Taxonomy, which deals with the classification and description of the various kinds of plants. A somewhat recently established branch of the science is that of Ecology, which deals with the distribution of plants in general. Another branch represents the practical aspects of botany by a particular investigation of the plants which can be made to enter into human economy. This is Economic Botany, the science which has the closest bearing on the arts of agriculture and horticulture. For a general discussion of botanical science, see:

Botany  
Biology  
Evolution  
Heredity

Botanical Laboratories (under Laboratory)  
Botanic Garden  
Herbarium  
Index Kewensis

For General Methods of Botanical Investigation, see:

### A. Structural Botany

This subject deals with the form and structure of individual plants, of the plant body as a whole, of its separate limbs and organs, of the various tissues of which these are composed, and of the minute structures of the cells which compose the tissues. The study of the individual cell has recently received so much attention that it has been elevated from a branch of Histology, which deals with the microscopic nature of tissues, to the separate science of Cytology. The study of the varying types of organs has been called Morphology, and this branch may be

divided into the morphology of the sterile or vegetative organs and the morphology of the reproductive organs.

For General Articles on Structural Botany, see:

Vegetable Tissue  
Anatomy of Plants  
Growth (in Plants)  
Morphology

**I. CYTOLOGY.** A description of the general structure and contents of the cell is given in the articles:

Cytology

Cell (in Plants)  
 Inter cellular System  
 Protoplasm  
 Nucleus  
 Osmosis  
 Plasmolysis  
 Movement  
 Rotation

For the composition of the cell wall, see:

Cellulose  
 Lignin  
 Lignification  
 Micellar Theory

For the structure of the nucleus, see:

Nucleolus  
 Linin  
 Chromatin  
 Chromosome  
 Centrosome

For the cytoplasm, see:

Microsome  
 Plastids

The protoplasmic contents include a considerable variety of coloring matter. See:

Color in Plants  
 Chromoplast  
 Chromatophore  
 Endochrome  
 Chloroplast  
 Anthocyan  
 Chlorophyll  
 Leucoplasts  
 Elaioplasts  
 Erythrophyll  
 Etiolin  
 Etiolation  
 Carotin  
 Cyanophyll  
 Phycoerythrin

Phycophaein  
 Pyrenoid

Besides the protoplasm the cell often contains crystals and other bodies.

See:

Raphides  
 Aleurone  
 Inulin  
 Starch

Finally the various constituents of the sap, digestive ferments, and secretions:

Sap  
 Sugar  
 Glucose  
 Enzyme  
 Diastase  
 Cytase  
 Lipase  
 Invertase  
 Oxidase  
 Pectase  
 Zymase  
 Latex

The mechanics of cell division are described under:

Mechanics of Development  
 Fission  
 Mitosis  
 Karyokinesis  
 Blepharoplast

**II. HISTOLOGY.** A general discussion of plant tissues is given in the article HISTOLOGY, section on *Histology of Plants*.

Tissues are variously classified. According to their general nature, the two most important kinds are described under:

Parenchyma  
 Collenchyma

In higher plants, the tissues are gen-

erally differentiated into three main systems. See:

Pith  
Wood  
Cortex

The general articles on woody tissue are:

Alburnum  
Duramen  
Vascular Tissue  
Conducting Tissue  
Mechanical Tissue  
Mestome  
Plerome

For the special structure of wood, see:

Fibrovascular Bundle  
Fibre  
Phloem  
Bast  
Hadrome  
Leptome  
Tylosis  
Trachæ (under Anatomy of Plants)  
Tracheid  
Sieve Vessels  
Cambium  
Pericycle  
Medullary Ray

The various tissues found in the cortex are described in the articles:

Meristem  
Epidermis  
Cuticle  
Endodermis  
Hypodermis  
Periblem  
Dermatogen  
Bark  
Cork  
Phelloderm  
Phellogen

Other special forms of tissue are:

Aërenchyma  
Palisade Cells  
Mesophyll

### III. MORPHOLOGY OF THE VEGETATIVE ORGANS.

For the general forms of plant bodies, see:

Thallus  
Herb  
Shrubs  
Tree  
Juvenile Forms

Some of the special forms or organs of fungi are described under:

Hypha  
Mycelium  
Plasmodium  
Pileus

Higher plants are generally differentiated into stem, root, and leaves, all of which may carry minor organs or appendages. See:

Stem  
Root  
Leaf

For special forms of stems, see:

Tuber  
Corm  
Internode  
Fasciation  
Phylloclad

For their mode of branching:

Branching  
Monopodial Branching  
Dichotomy

For the forms and appearance of leaves, see:

Fronde  
Pinnule  
Phyllodes

Petiole  
Venation  
Variegation  
Anisophylly  
Heterophylly

For their arrangement in the bud,  
see:

Leaf-Buds (under Bud)

The forms and appendages of the  
roots are described in the articles:

Root  
Rhizoids  
Root Tubercles

For the organs of respiration and  
exudation, see:

The Aërating System (under Anat-  
omy of Plants)

Stomata  
Lenticels  
Hydathode

For the organs of support and sim-  
ilar use, see:

Tendrils  
Haustoria

Other appendages of plants are de-  
scribed under:

Trichome  
Gland  
Cilia of Plants  
Bloom

#### IV. MORPHOLOGY OF THE REPRO- DUCTIVE ORGANS.

The vast majority of plants produce  
at certain periods of their life-history  
two sets of reproductive organs, the  
sexual and the asexual; and, in all  
plants above the algæ and fungi, these  
follow each other regularly in alter-  
nate generations. (See the general  
articles on sexual processes referred to  
under Physiology.) In this section,  
only those articles will be given which

describe the sexual and asexual repro-  
ductive organs. These organs are  
present in some form throughout large  
classes of plants. Special morphology  
will be discussed under the appropriate  
heads in Systematic Botany.

Asexual reproduction is effected by  
spores and by vegetative off-shoots.  
For the latter, see:

Bud  
Gemmæ  
Bulb

For the organs of spore-reproduc-  
tion, see:

Spore  
Intine  
Homospory  
Heterospory  
Microspore  
Megaspore  
Sporangium  
Microsporangium  
Megasporangium  
Sporophyll  
Microsporophyll  
Megasporeophyll

The organs of sexual reproduction  
are:

Gamete  
Generative Cell  
Oösphere  
Sperm  
Antheridium  
Archegonium  
Oögonium  
Paraphyses  
Oöspore

In the higher plants (Spermatophytes), the two sets of reproductive  
organs, sexual and asexual, are enclosed  
together in the flower. See:

Flower  
Seed  
Fruit

For the various modes in which flowers are arranged on the plant, see:

Inflorescence

Panicle

Cyme

Corymb

Ament

Disk

The parts of a flower are described in the articles:

Involucre

Calyx

Pappus

Corolla

Petal

Ligule

Nectary

Pistil

Ovary

Carpel

Ovule

Placenta

Stamen

Anther

Pollen

Epigyny

Hypogyny

Perigyny

The articles on the seed are:

Seed

Endosperm

Perisperm

Ovule

Nucellus

Embryo

Suspensor

Cotyledon

Hypocotyl

For the various kinds of fruits, see:

Achene

Berry

Capsule

Caryopsis

Drupe

Drupelet

Follicle

Glume

Legume

Nut

Pome

## B. Physiology

Physiology is the science which deals with all the processes that constitute the life of an individual plant, the conditions, both internal and external, which affect plant life, and all the phenomena attending such processes and conditions. Just as we distinguish between vegetative and reproductive organs of a plant, so we may also distinguish between vegetative and reproductive life processes; and the former may be divided into the regular and constant processes, which maintain the

life of a plant, and the more occasional responses to stimuli. Abnormal and pathological conditions also come within the scope of physiology. See **PHYSIOLOGY OF PLANTS**.

I. In all perfect plants, there is a series of regular mechanical processes by which raw food material is brought to the digestive organs in the form of gases from the atmosphere, or of minerals dissolved in water from the soil; by other processes the digested food is carried to places of storage or growing

points, and the waste products are expelled from the system. See:

Respiration (in plants)

Aëration

Absorption (in plants)

Transpiration

Potometer

Imbibition

Osmosis

Turgor

Root Pressure

Conduction

Storage

Excretion

Secretion (vegetable)

II. The phenomena of digestion and growth are described in the articles:

Digestion in Plants

Food of Plants

Nutrition (in plants)

Mycorrhiza

Photosynthesis

Etiolation

Metabolism

Katabolism

Anabolism

Fermentation

Assimilation

Regeneration

Parasite, Plant

Saprophyte

Carnivorous Plants

Insectivorous Plants

Energy of Plants

Growth (in plants)

Auxanometer

Enzymes

Chloroplasts

Carotin

Etiolin

The various movements which plants are capable of are described under:

Movement

Moving Plant

Motor Organ

Locomotion

Nutation (in plants)

Plants are also capable of reacting to a great variety of stimuli. See:

Irritability

Stimulus

Tropism

Phototaxis

Heliotropism

Photoepinasty

Apheliotropism

Paraheliotropism

Nyctotropic

Sleep of Plants

Geotropism in Plants

Apogeotropism

Diageotropism

Hydrotropism

Aphydrotropism

Aërotropism

Rheotropism

Thermotropism

Chemotaxis

Chemotropism

Electrotaxis

Electrotropism

Traumatropism

Sensitive Plant

Hyponasty

Epinasty

Clinostat

Tendrils

Lianas

Reproductive processes may be divided into those which take place within the individual plant, and those which are affected by the relation of the individual plant to its environment. The latter are referred to under Ecology (see C below), while only the former are described in the following articles:

Reproduction (in plants)

Vegetative Propagation

Sex in Plants (under Sex)

Conjugation

Rejuvenescence

Isogamy

Apogamy

Parthenogenesis

Vivipary

Fertilization

Germination

Alternation of Generations

Gametophyte

Sporophyte

A discussion of the abnormal and pathological in plant life is given in the articles:

Teratology

Monstrosity

Malformation

Abortion in Plants (under Abortion)

Vestigial Structures

Concrescence

Galls

## C. Ecology

Ecology is the science that deals with the relation of a plant to its environment. This relation may be that of sexual intercourse, relation to the soil, situation, climate, moisture conditions, relation to other plants and to animals, and any other external conditions that affect the situation of a plant, its growth, or the length of its life, either in the individual or in the species or race. Ecology is thus the study of the distribution of plants in the broadest sense. See:

Ecology

Distribution of Plants

Bionomics

Floristics

Dysteleology

Adaptation

Epharmony

1. The relations of the reproductive functions of a plant to the environment are discussed in the articles:

Pollination

Pollen

Hybrid

Dispersal

The special arrangements which

affect cross-pollination are described under:

Cleistogamy

Allogamy

Geitonogamy

Monœcism

Diœcism

Dichogamy

Entomophilous Plant

Anemophilous Plants

Hydrophilous

For the relation of plants to the soil, see:

Humus Plants

Lime Plants

Clay-Plants

Nitrophilous Plants

Halophyte

Dune Vegetation

Rock Plants

Epiphyte

For the relation of plants to general localities, see:

Autochthonous

Endemism

Naturalization

Migration of Plants



and, to specific situations:

Mountain Plants

Alpine Plant

Cliff-Plants

Beach Plants

Ruderal Plants

Hylophytes

Benthos

Enalids

Plankton

For the relation of a plant to moisture and climate, see:

Hydrophytes

Hygrophytes

Mesophyte

Amphibious Plants

Xerophytes

Desert Vegetation

Arctic Plants (under Arctic Region)

Acclimatization

Phenology

The relation of a plant to other plants, and to animals, may be considered under two aspects:

(a) There is often a close sympathetic relation between individual plants, and between an individual plant and animals. See:

Symbiosis

Endophyte

Epiphyte

Parasite, Plant

Obligate Plants

Faculative Plant

Entomophilous Plant

Myrmecophytes

Phycomycetes

(b) There is also a general relation due to soil, climate, struggle for existence, etc., between large numbers of individuals growing together and constituting what are known as plant societies. See:

Distribution of Plants

Form

Formation

Forest

Jungle

Thicket

Grasslands

Savannas

Steppe

Prairie

Llanos

Pampas

Meadow

Tundra

Swamp

Mangrove Swamp

Cypress Swamps

The nature of plant societies is also largely affected by the vegetative duration of its members. See:

Duration

Annuals

Biennials

Perennials

Æstival

Vernal Grass

Deciduous Plants

Evergreen

Geophyte

## D. Systematic Botany

This branch of the science of Botany comprises the classification of plants, the description of every known species

and of the larger divisions—genera, families, orders, classes, etc.—into which all species are grouped. Sys-

tematic Botany also includes the study of the relationships between the various groups and species of plants, and of their geographical distribution. It is obviously impossible here to refer to all the articles on even the more important genera; but, as the representative genera of each order are referred to in the article on the order, it is sufficient to give only the latter and the higher groups. For a general article on systematic botany, see **TAXONOMY**.

The whole vegetable kingdom is generally divided into four sub-kingdoms. See:

Thallophytes  
Bryophytes  
Pteridophytes  
Spermatophytes

I. The Thallophytes are divided into two parallel series. See:

Algæ  
Fungi

1. The Algæ are generally grouped into four classes. See:

Cyanophyceæ  
Chlorophyceæ  
Phæophyceæ  
Rhodophyceæ

2. For the main divisions of the Fungi, see:

Myxomycetes  
Schizomycetes  
Ustilaginales  
Phycomycetes  
Ascomycetes  
Uredinales  
Basidiomycetes  
Lichens

II. The Bryophytes are grouped in two main divisions. See:

Hepaticæ

Musci

III. The living Pteridophytes fall into three main groups, the last two of which are generally called "the higher fern." See:

Fern  
Equisetum  
Lycopodiales

IV. The Spermatophytes, or seed-plants, form the bulk of the vegetation which covers the earth. They are divided into two classes. See:

Gymnosperms  
Angiosperms

1. The living Gymnosperms are grouped into four orders. See:

Coniferæ  
Cycadaceæ  
Gnetaceæ  
Ginkgo

2. The Angiosperms consist of numerous orders, which fall into two natural sub-classes. See:

Monocotyledons  
Dicotyledons

(a) The principal orders of Monocotyledons are described under:

Pandanaceæ  
Typha  
Gramineæ  
Cyperaceæ  
Palm  
Arum  
Bromeliaceæ  
Liliaceæ  
Smilaceæ  
Amaryllidaceæ  
Dioscoreaceæ  
Iridaceæ  
Musaceæ  
Zingiberaceæ  
Orchid

(b) The following are the most important orders of Dicotyledons, arranged in their order of relationship. Important genera of orders not separately described are inserted in their proper places.

*Archichlamydeæ:*

Mainly Apetalous. Chiefly  
Trees:

Piperaceæ  
Juglandaceæ  
Willow  
Poplar  
Birch  
Alder  
Cupuliferæ  
Moraceæ  
Urticaceæ  
Elm

Chiefly Weeds:

Polygonaceæ  
Chenopodiaceæ  
Amarantaceæ  
Mesembryaceæ  
Caryophyllaceæ

Mainly Polypetalous. Butter-  
cup Types:

Nymphæaceæ  
Magnolia  
Ranunculaceæ  
Berberidaceæ  
Lauraceæ

Poppy Types:

Papaveraceæ  
Fumariaceæ  
Cruciferæ

Insectivorous Plants:

Sarracenia  
Sundew

Rose Types:

Saxifrage

Plane

Rosaceæ

Leguminosæ

Geranium Types:

Geranium  
Zygophyllaceæ  
Polygala  
Euphorbiaceæ

Maple Types:

Burseraceæ  
Anacardiaceæ  
Holly  
Maple  
Sapindaceæ  
Horse-Chestnut

Buckthorn Types:

Rhamnaceæ  
Vitaceæ

Mallow Types:

Tiliaceæ  
Malvaceæ

Violet Types:

Ternstroemiaceæ  
Violaceæ

Cactus Type:

Cactus

Myrtle Types:

Lythraceæ  
Myrtaceæ

Carrot Types:

Umbelliferæ  
Dogwood

*Sympetalæ:*

Heath Types:

Ericaceæ  
Huckleberry

Primrose Type:

Primulaceæ

Ebony Types:

Sapotaceæ  
Ebony

**Gentian Types:**

Loganiaceæ  
Gentianaceæ  
Apocynaceæ  
Asclepiadaceæ

**Phlox Types:**

Convolvulaceæ  
Polemoniaceæ  
Boraginaceæ  
Labiatæ

**Solanaceæ**

**Scrophulariaceæ**

**Bignonia**

**Madder Types:**

Rubiaceæ  
Caprifoliaceæ

**Bell-Flower Types:**

Cucurbitaceæ  
Campanulaceæ  
Compositæ

## *E. Economic Botany*

In its narrow sense, viewed as a strictly botanical science, economic botany is the study of those plants which are, or can be, used for some purpose in human economy. If we inquire further into the methods by which these plants are made available, we enter upon the fields of agriculture, pharmacy, mechanical arts, etc. By the above definition, economic botany includes a study of the common cultivated plants, such as the cereals, but, to avoid repetition, the cultivated plants are referred to only in the chapter on Agriculture, Horticulture, and Forestry. We shall therefore confine ourselves here to the articles describing the important wild, or not commonly cultivated, economic plants, classified according to their uses.

### **I. PLANTS USED FOR FOOD:**

Adansonia  
Areca  
Banana  
Brazilnuts  
Breadfruit Tree  
Butter-Tree  
Caryocar  
Caryota

Cashew Nut  
Cherimoyer  
Cocco  
Cocoanut  
Euryale  
Fungi, Edible  
Granadilla  
Grass-Tree  
Hog-Plum  
Iceland Moss  
Jubæa  
Mammee Apple  
Maple  
Mushroom  
Nelumbo  
Palmyra Palm  
Papaw  
Prickly Pear  
Reindeer Moss  
Sago  
Tamarind  
Ti  
Walnut  
Water-Chestnut

### **II. PLANTS USED IN PREPARING BEVERAGES:**

Beverage Plants  
Agave  
Assai

Ava  
Buriti Palm  
Carrageen  
Elder  
Maté  
Palmyra Palm  
Sloe  
Woodruff

**III. PLANTS USED AS CONDIMENT OR  
IN CONFECTIONERY:**

**Flavoring Plants**

Anise  
Caper  
Cardamom  
Cinnamon  
Coriander  
Ginger  
Jujube  
Juniper  
Laurel  
Licorice  
Marjoram  
Marsh-Mallow  
Mint  
Pepper  
Tonka Bean  
Vanilla

**IV. PLANTS USED IN PERFUMERY:**

Boswellia  
Lemon-Grass  
Lignum Rhodium  
Lily of the Valley  
Musk Plant  
Myrrh  
Patchouli  
Ylang Ylang

**V. PLANTS YIELDING PIGMENTS:**

Alkanet  
Aloe  
Brazil Wood  
Buckthorn  
Butea

Camwood  
Chay Root  
Fustic  
Henna  
Indigo  
Logwood  
Marking-Nut  
Walnut  
Weld  
Yam  
Zamia

**VI. PLANTS YIELDING GUMS, WAX,  
OILS, ETC.:**

Butter Tree  
Calophyllum  
Canarium  
Candleberry  
Candle-Nut  
Carnauba Palm  
Cashew Nut  
Dammar  
Elæococca  
Fir  
Grass-Tree  
Mastic  
Mesquite Tree  
Oil Palm  
Pine  
Tallow Tree

**VII. PLANTS YIELDING FIBRE:**

Agave  
Aloe  
Astrocaryum  
Attalea  
Bromelia  
Broom  
Butea  
Carnauba Palm  
Caryota  
Chamærops  
Corchorus  
Crotalaria

Eriodendron  
Giant Lily  
Gomuti  
Jute  
Kapok  
Ootrum  
Piassaba  
Yucca

VIII. PLANTS USED FOR TIMBER AND  
CABINET WOOD:

Ash  
Boxwood  
Butternut  
Calophyllum  
Cedar  
Cypress  
Dacrydium  
Dalbergia  
Elm  
Eucalyptus  
Fir  
Gmelina  
Greenheart  
Guaiacum  
Hemlock Tree  
Hornbeam  
Ilex  
Kauri Pine  
Lignum Vitæ  
Lime Tree  
Mammee Apple  
Maple  
Oak  
Palmetto  
Palmyra Palm  
Pine  
Plane  
Podocarpus  
Spruce  
Tamarind  
Teak  
Tulip Tree  
Walnut

IX. PLANTS USED FOR ORNAMENTAL  
CABINET WOODS:

Aloes Wood  
Ebony  
Holly  
Letterwood  
Mahogany  
Palmyra Wood  
Rosewood  
Sandalwood  
Satinwood

X. PLANTS SUPPLYING VARIOUS PRIM-  
ITIVE NEEDS:

Bottle Gourd  
Bussu Palm  
Calabash Tree  
Daphne  
Nipa  
Palmyra Palm  
Papyrus  
Rattan

XI. PLANTS USED DIRECTLY IN IN-  
DUSTRIAL ARTS:

Carludovica Palmata  
Ice Plant  
Ivory, Vegetable  
Myrobalan  
Oak  
Quebracho  
Rattan

XII. MEDICINAL PLANTS:

Aconite  
Acorns  
Adansonia  
Agrimony  
Akee  
Allamanda  
Aloe  
Alum Root  
Angelica  
Angostura Bark  
Aristolochia  
Arnica

Asarabacca  
 Belladonna  
 Bittersweet  
 Broom  
 Butterfly-Weed  
 Cajeput  
 Calabar Bean  
 Carrageen  
 Cascarilla  
 Cassia  
 Centaury  
 Choke-Cherry  
 Cinchona  
 Cissampelos  
 Coca  
 Croton  
 Cubebs  
 Dill  
 Dock  
 Dogbane  
 Elder  
 Erigeron  
 Ergot  
 Eucalyptus  
 Feverwort  
 Gentian  
 Geum  
 Guaiacum  
 Horehound  
 Houseleek  
 Ipecacuanha  
 Jalap  
 Licorice  
 Mint  
 Myrrh  
 Poppy  
 Strychnos  
 Witch-Hazel  
 Zanthoxylum

### XIII. POISONOUS PLANTS:

Poisonous Plants  
 Abrus  
 Amanita

Andromeda  
 Belladonna  
 Bittersweet  
 Bitterwood  
 Calabar Bean  
 Cherry-Laurel  
 Cocculus Indicus  
 Colchicum  
 Fungi, Edible and Poisonous  
 Hemlock  
 Henbane  
 Kalmia  
 Laburnum  
 Manchineel  
 Nightshade  
 Poison Oak  
 Stramonium  
 Sumach  
 Tanghin  
 Upas

### XIV. BIOGRAPHIES OF EMINENT BOTANISTS:

Adanson, M.  
 Barton, W. P. C.  
 Bauhin, J.  
 Bentham, G.  
 Bigelow, J.  
 Bonnier, G.  
 Boussingault, J. B. J. D.  
 Braun, A.  
 Brongniart, A. T.  
 Brown, R.  
 Brunfels, O.  
 Chapman, A. W.  
 Cohn, F. J.  
 Darlington, W.  
 De Candolle, A. L. P. P.  
 Desfontaines, R. L.  
 Eichler, A. W.  
 Engler, H. G. A.  
 Endlicher, S. L.  
 Gray, Asa  
 Grew, N.

Hellriegel, H.  
Hooker, Sir J. D.  
Hooker, Sir W. J.  
Jackson, B. D.  
Jussieu  
Ledebour, K. F. de  
Lenné, P. J.  
Lindley, J.  
Link, H. F.  
Linnæus, Carolus  
Michaux, A.  
Mohl, H. von  
Morong, Thomas  
Muhlenberg, G. H. E.  
Nees von Esenbeck, C. G.  
Nuttall, T.

Persoon, C. H.  
Pfeffer, W.  
Plumier, Charles  
Rafinesque, C. S.  
Sachs, J. von  
Saussure, N. T. de  
Schleiden, M. J.  
Schultze, M. S.  
Schweinitz, L. D. von  
Sullivant, W. S.  
Thunberg, K. P.  
Thurber, George  
Torrey, J.  
Tournefort, J. P. de  
Unger, F.  
Watson, S.



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## Chapter 26. Agriculture, etc.

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**T**HE systematic and artificial cultivation of plants for the purpose of supplying human necessities or luxuries constitutes the arts of Agriculture, Horticulture, and Forestry, or the cultivation of the field, the garden, and the forest. The distinctions between these three arts, however, are not so definite as one might suppose, and the apportionment among them of the articles dealing with plant culture will be more or less arbitrary. Thus Forestry and Horticulture meet in the arts of Arboriculture and Landscape Gardening. The products of Horticulture are, as a rule, luxuries rather than necessities; but the raising of vegetables for the table, although they are almost necessary articles of food, is generally treated under Horticulture rather than under Agriculture. The latter term is best confined to the cultivation on a large scale of products used extensively in human economy, and this distinction will be the basis for the following divisions of the whole subject.

### A. Agriculture

Agriculture, as its name implies, is the cultivation of the field, mainly for the purpose of providing a regular supply of organic food, both plant and animal. This indicates the two main divisions of farming, namely, the raising of food plants and the raising of animals. The former is, perhaps, the more complex process, requiring a more elaborate equipment of tools and machinery. It involves the selection and preparation of the soil, the sowing of the seed, the care of the growing crop, the prevention and cure of crop diseases, and the harvesting, manipulation, and disposition of the crop when ripe. The raising of animals involves their selection and breeding, the feeding and care of the animals, attention to the numerous diseases to which they are subject, and the manipulation and disposition of animal products, including the art of dairying. In connection with both branches of agriculture, there is the general management of the farm and its equipment. For a history of

the development of agriculture in the various countries, see the article, **AGRICULTURE**.

I. For the general articles on the farm and its equipment, see:

- Farm Buildings
- Implements, Agricultural
- Farm Management
- Dry Farming

II. The preparation of the soil requires, first, the selection of a soil suited for the crop, and often its artificial fertilization; and, second, its tillage and irrigation.

For the selection of soil, see:

- Soil
- Humus
- Alkali Soils
- Chernozem
- Gumbo Soil
- Fallow
- Waste Lands
- Rotation of Crops

For fertilization and fertilizers, see:

- Chemistry, Agricultural

**Fertilizers****Manures and Manuring****Green Manuring****Nitrification****Sewage Farming****Soil Amendments****Fish Manures****Bone Fertilizers****Guano****Marl****Compost****Gypsum****Poudrette****Lupine****Superphosphate****Thomas Slag**

The processes of tillage are described under :

**Tillage****Cultivator****Plow, Plowing**

For the irrigation and drainage of the soil, see :

**Irrigation****Drainage****Ditch****Mulch****Warping****Lysimeter**

When the soil has been prepared and tilled, the seed is sown. See :

**Seed Testing****Broadcasting****Drill****Harrow**

When the crop is ripe, it is harvested and prepared for the market. See :

**Harvest and Harvesting****Reapers, Reaping****Threshing****Hummeler****Fan, or Fanner**

III. The principal crops which are the subjects of agriculture are, of course, the food plants, and of these the most important are the cereals. Other plants, however, aside from those which are the subjects of horticulture, are also regularly cultivated, such as forage plants (see under **Stock-Raising** below), and plants used for fibre and various other purposes.

For the principal cereals, see :

**Cereals****Barley****Buckwheat****Maize****Millet****Oat****Rice****Rye****Wheat**

Other food crops are :

**Artichoke****Artichoke, Jerusalem****Bean****Beet****Cassava****Cowpea****Dolichos****Lentil****Pea****Potato****Pumpkin****Sago****Sorghum****Soy Bean****Sugar Beet****Sugar-Cane****Sweet Potato**

(For vegetables and fruits, see under section on **Horticulture**.)

Plants cultivated for fibre are :

**Bœhmeria****Cotton**

Flax  
Hemp  
Hemp, Bowstring  
Hemp, Manila  
Hemp, Sisal  
Hemp, Sunn  
Henequen  
Ramie

Tobacco is also an important agricultural crop. See article TOBACCO.

IV. The care of the growing crop is of sufficient importance to have separate treatment, and the study and treatment of plant diseases is a science by itself. The principal cause of plant diseases are bacteria and fungi, and almost every kind of crop has its specific insect pests. These are all described in separate articles following the articles on the crops, under such titles as COTTON INSECTS, RICE INSECTS, etc., and, therefore, need not be enumerated here. The general articles on plant diseases and their treatment, and on diseases common to several crops are:

Diseases of Plants  
Fungicides  
Insecticides  
Insect Powder  
Mildew  
Blight  
Botrytis  
Canker  
Chlorosis  
Damping Off  
Dry Rot  
Ergot  
Gummosis  
Rust  
Smuts

The special diseases which affect particular crops are treated in the ar-

ticles on the separate crops, but a few are described in separate articles. See:

Bunt  
Cornstalk Disease  
Crown-Gall  
Ear Cockles  
Clubroot  
Oidium

Some of the common weeds with which the farmer and gardener have to contend are described in the articles:

Weed  
Burdock  
Chickweed  
Chufa  
Cockle  
Chenopodium  
Dodder  
Orache  
Pigweed  
Tare

V. The raising of live-stock is the second great department of agriculture, and involves the selection of the animals, their breeding and general care, a supply of the proper feed stuffs; attention to diseases, which constitutes the practice of veterinary medicine; and the preparation of the animal products for the market.

The most important animals raised as live-stock are described in the articles:

Horse  
Cattle  
Mule  
Sheep  
Goat  
Hog  
Poultry  
Fowl  
Duck  
Goose

Turkey

Pigeon

Bee

For the breeding and general care  
of the animals, see:

Breeds and Breeding

Incubator

Horseshoeing

Hoof

Dhorning

Feeding Farm Animals

Soiling, Soiling Crops

Bee-Keeping

Feeding stuffs may be divided into  
two general classes, natural or grow-  
ing forage plants and the more or  
less artificially prepared feeds. The  
forage plants may again be divided  
into grasses and those that are not  
grasses, the latter being largely legu-  
minous plants. See:

Feeding Stuffs

Pasture

Meadow

For forage grasses, see:

Grasses

Agropyron

Andropogon

Bermuda Grass

Blue Grass

Brome Grass

Buffalo-Grass

Canary-Grass

Crab-Grass

Gama Grass

Manna-Grass

Meadow Grass

Millet

Oat Grass

Orchard Grass

Redtop Grass

Rye-Grass

Sorghum

Teosinte

Timothy Grass

The principal forage plants other  
than grasses are:

Alfalfa

Burnet

Chufa

Clover

Cowpea

Fescue

Lupine

Mangel-Wurzel

Medicago

Medick

Melilot

Rape

Sainfoin

Serradella

Soy Bean

Sulla

Trefoil

Vetch

For the most important prepared  
feeds, see:

Brewers' Grains

Gluten Meal

Cottonseed Meal

Hay

Linseed Meal

Malt Sprouts

Silage

Farm animals are subject to numer-  
ous serious diseases, and the investiga-  
tion and treatment of these constitute  
the profession of veterinary medicine.  
A convenient subdivision of animal  
diseases is according to the kinds of  
animals which they affect, since, with  
a few exceptions, each disease is either  
peculiar to, or chiefly prevalent in, a  
particular species. Several of these  
given under cattle diseases, however,

may also affect horses or sheep, and vice versa.

(a) The general articles on the subject and those dealing with diseases common to several kinds of live-stock are:

Veterinary Medicine  
Diseases of Animals  
Abortion  
Anthrax  
Colic in Animals  
Ring Worm  
Mange  
Tuberculosis (in animals)

(b) For diseases primarily affecting the horse, see:

Azoturia  
Bighead  
Canker  
Curb  
Fistula  
Founder  
Glanders  
Heaves  
Hoof  
Influenza in Animals  
Meningitis  
Navicular Disease  
Roaring  
Strangles  
Stringhalt  
Spavin  
Thrush

(c) For diseases of cattle, see:

Actinomycosis  
Blackleg  
Cattle Plague  
Fardel-bound  
Foot-and-Mouth Disease  
Joint-Ill  
Malignant Catarrh  
Mammitis  
Milk Fever

Red Water  
Texas Fever

(d) For diseases of sheep, see:

Agalactia  
Bloat  
Braxy  
Fardel-bound  
Gid  
Ictero hæmaturia  
Liver-Rot  
Lung-Worms  
Nodular Disease

(e) For a disease of hogs, see:

Hog Cholera

(f) For diseases of poultry and bees, see:

Blackhead  
Gapes  
Roup  
Diarrhœa, White, of Chickens  
Foul Brood

VI. In the preparation of animal products for the market, one of the most elaborate, as well as important, departments is that of Dairying. This industry involves the supply of milk and cream, and the manufacture of butter and cheese. For a general article on the subject and articles on the processes of manufacture, and the machinery and equipment of the dairy; see:

Dairying  
Milking Machine  
Aëerator  
Creamery  
Separator  
Butter-Making  
Churn  
Butter-Worker  
Butter-Color  
Cheese-Making

Cheese Factory

Rennet

For the principal dairy products,  
see:

Milk

Skim Milk

Cascin

Cream

Butter

Cheese

Buttermilk

Milk Sugar (under Sugars)

Ghee

Kephir

Koumiss

Whey

VII. Other more or less direct products of agriculture and stock raising, and the methods of their disposal, are described under:

Market and Marketing

Flour

Farina

Semolina

Food

Bread

Sugar

Honey

Glucose

Meat

Pork

Leather

Wool

See also POULTRY and EGG and the articles there referred to.

VIII. Since the patriarchal stage, Agriculture has been regarded as the most important of human industries, and is the one which has especially received direct and official attention from the governments of civilized nations. There are also at present numerous educational institutions, and private or semi-public associations for the advancement of the industry. See:

Agriculture, U. S. Department of  
Agricultural Experiment Station  
Agricultural Education  
Farmers' Institute  
Agricultural Association  
Grange

IX. For biographies of eminent agriculturists, see:

Atwater, W. O.  
Brewer, W. H.  
Goodell, H. H.  
Harris, J.  
Hellriegel, H.  
Hilgard, E. W.  
Holdefleiss, F. W.  
Johnson, S. W.  
Judd, O.  
Lawes, J. B.  
Maercker, M.  
Morris, Daniel  
Ruffin, E.  
Thaer, A. D.  
True, A. C.  
Wallace, R.  
Young, A.

## *B. Horticulture and Forestry*

Horticulture is the art of producing plants which are valued for their agreeable properties rather than as necessities for human comfort. The horticultural methods of breeding,

propagating, and cultivating plants differ essentially from the agricultural method in that great attention is paid to the individual plant, while in agriculture attention is given to the crop

as a whole, in which the individual is lost. The subjects and products of horticulture are flowers, ornamental shrubs and trees, fruit trees, plants used as condiments, vegetables for the table, when considered merely as accessories to the more substantial articles of food, and all other plants treated by horticultural methods.

Horticulture also concerns itself with the laying out of gardens, and in this field of its activity it merges into landscape gardening and forestry. The latter, however, is a purely economic art and is not a branch of horticulture. It is included in this section because it is not yet a highly complex art and is, therefore, treated in a few general articles. For the general articles on Horticulture and Forestry, see:

- Horticulture
- Floriculture
- Landscape Gardening
- Arboriculture
- Forestry
- Afforestation

I. The buildings and equipments used by the horticulturist are described in the articles:

- Greenhouse
- Hothouse
- Conservatory
- Frame
- Espalier
- Hoe

One of the principal aims of horticulture is to develop particularly desirable varieties of plants and to maintain them true to the stock. For this purpose, special methods of breeding and propagation are necessary. See:

- Plant-Breeding

- Nursery
- Budding
- Cutting
- Grafting
- Layering
- Caprification

Special methods are also necessary in raising the young plants to maturity and securing the desired qualities in the matured product. See:

- Forcing
- Bottom Heat
- Electro-culture of Plants
- Pruning
- Cordon
- Blanching

For the most important plants cultivated in greenhouses, see:

- Greenhouse Plants
- Achimenes
- Azalea
- Banksia
- Carnation
- Chrysanthemum
- Fuchsia
- Gardenia
- Gladiolus
- Hyacinth
- Lily, Lily of the Valley
- Mignonette
- Oleander
- Passion-Flower
- Pelargonium

II. The principal articles on gardens, ornamental shrubs, and garden plants are:

- Lawn
- Hedge
- Ampelopsis
- Azalea
- Canna
- Centaurea
- Chrysanthemum

Convolvulus  
Cosmos  
Cotoneaster  
Cowslip  
Dahlia  
Eschscholtzia  
Heliotrope  
Hibiscus  
Hollyhock  
Hyacinth  
Hydrangea  
Ivy  
Jasmine  
Jonquil  
Laburnum  
Larkspur  
Laurustinus  
Lavender  
Libocedrus  
Lilac  
Lily  
Lily of the Valley  
Mignonette  
Narcissus  
Peony  
Petunia  
Phlox  
Pink  
Polyanthus  
Poppy  
Rose  
Star of Bethlehem  
Sunflower  
Sweet Pea  
Thrift  
Tropæolum  
Trumpet Flower  
Tuberose  
Tulip  
Wallflower  
Wistaria

Fruit, Cultivated  
Orchard  
Apple  
Apricot  
Banana  
Blackberry  
Butternut  
Calville  
Cherimoyer  
Chestnut  
Cranberry  
Currant  
Custard-Apple  
Date  
Dewberry  
Earthnut  
Fig  
Gooseberry  
Grape  
Hazelnut  
Huckleberry  
Kumquat  
Lemon  
Lime  
Litchi  
Loquat  
Mango  
Melon  
Mulberry  
Muskmelon  
Olive  
Orange  
Peach  
Peanut  
Pear  
Persimmon  
Pineapple  
Plum  
Pomegranate  
Quince  
Raspberry  
Strawberry  
Walnut  
Watermelon

III. For the principal articles on  
fruit trees and fruit culture, see:



For table vegetables, see:

Vegetables  
Herbs, Culinary  
Salad Plants  
Asparagus  
Brussels Sprouts  
Cabbage  
Carrot  
Cauliflower  
Celery  
Corn-Salad  
Cress  
Cucumber  
Egg Plant  
Endive  
Garlic  
Kale  
Kohl-rabi  
Leek  
Lettuce  
Mushroom  
Onion  
Parsley  
Parsnip  
Radish  
Rhubarb  
Salsify  
Spinach  
Squash  
Tomato  
Truffle  
Turnip

V. For the principal plants cultivated for their flavoring qualities, see:

Flavoring Plants  
Allspice  
Almond  
Capsicum  
Caraway  
Chicory  
Chive  
Cinnamon  
Citron

Cloves  
Fennel  
Hop  
Horseradish  
Mace  
Mustard  
Nutmeg  
Pepper  
Pistacia  
Thyme  
Vanilla

VI. The section on horticulture should also include reference to the articles on the well known beverage plants, and on some of the more direct products of horticulture. See:

Coffee  
Tea  
Cacao  
Wine  
Cider  
Prune  
Raisins

VII. For biographies of eminent horticulturists and foresters, see:

Bailey, L. H.  
Burbank, L.  
Downing, A. J.  
Downing, C.  
Duhamel du Monceau  
Henderson, P.  
Hess, R.  
Heyer, G.  
Heyer, K. J.  
Hovey, C. M.  
Kenrick, W.  
Koristka, K. von  
Landreth, D.  
Lodeman, E.  
Longworth, N.  
Loudon, J. C.  
Lyon, T. T.  
Manning, R.

See also HORTICULTURAL SOCIETIES.

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## Chapter 27. Zoology

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**E**VERY topic of importance in Natural History, especially as represented in America, is contained in the pages of the *New International Encyclopædia*, which thus may justly be called a complete text-book of zoölogy. The outline of our knowledge of animal life thus furnished is supplemented, in respect to each part of it, by references to special books, museum collections, and other sources of knowledge where the student may find the minute details and investigations interesting and necessary to the specialist, but superfluous to a general reader. The material contained in the Encyclopædia is thus equally useful to the deep and to the superficial inquirer; for the specialist in one department of science needs to have at hand general information, at least, as to other departments.

Zoölogy has two aspects: (a) that of its observed facts; and (b) that of the principles involved: phenomena and deductions; condition and theory. The foremost or basic part is a knowledge of the facts of the animal world, namely: Form and Structure; Reproduction, Embryology and Growth; Habit; Instinct; Distribution, past and present; Relationship, of animals to one another, and to their environment. From these have been deduced the facts of the Classification and Evolution of forms.

### STRUCTURE.

The reader who seeks to take the topics dealing with Form and Structure in order may read the following articles:

Biology  
Morphology  
Animal  
Protoplasm  
Cell  
Amœba  
Embryology  
Anatomy  
Bone  
Skeleton; and the more particular accounts of its component parts, as SKULL, HAND, SHOULDER-JOINT, etc.  
Muscular System  
Circulatory System  
Alimentary System  
Excretory System  
Respiratory System  
Nervous System and Brain

Cephalization  
Metamerism  
Integument  
Horn  
Hoof  
Nail  
Teeth  
Hair  
Feather  
Pterylosis  
Scales  
Pigment  
Metachrosis  
Chromatophore  
Melanism  
Touch  
Taste  
Smell  
Eye  
Ear

The structure of various animals, as characteristic of groups, is given in such general articles as:

Amblypoda

Ammonites  
 Amphibia  
 Annulata  
 Arachnida  
 Archæopteryx  
 Bat  
 Beetle  
 Bird  
 Bovidæ  
 Butterflies and Moths  
 Brachiopoda  
 Camelidæ  
 Canidæ  
 Carnivora  
 Cephalopoda  
 Cestoda  
 Chordata  
 Cœlenterata  
 Coral  
 Crinoidea  
 Crustacea  
 Deer  
 Dinosauria  
 Dipnoi  
 Echinodermata  
 Elasmobranchii  
 Electric Fish  
 Felidæ  
 Fish  
 Fly  
 Fringillidæ  
 Frog  
 Ganoidei  
 Gastropoda  
 Holothurian  
 Horse, Evolution of the (under  
     Horse, Fossil)  
 Hydrozoa  
 Hymenoptera  
 Infusoria  
 Insect  
 Mammalia  
 Marsupialia  
 Medusa

Mollusca  
 Ophiuroidea  
 Prototheria  
 Protozoa  
 Pterodactyl  
 Pteropoda  
 Reptile  
 Rodentia  
 Sirenia  
 Snake  
 Turtle  
 Ungulata  
 Vertebrata

For the most part, the articles referred to contain, incidentally or cited in the appended Bibliography, the names of investigators identified with these particular subjects. In the great majority of cases the biography of each of these men is to be found in its alphabetical position in the *Encyclopædia*; and an earnest reader will turn to it, and so acquaint himself with the man by whose learning he is profiting.

#### REPRODUCTION AND GROWTH.

Animals continue to exist by reproducing their kind after various methods, and each individual passes through a more or less complicated series of changes from its beginning to its maturity, collectively known as its life-history, or autogeny. An orderly study of this essential phase of animal life may be conducted by reading the articles mentioned below, with the lesser ones indicated by cross-references:

Reproduction  
 Spontaneous Generation  
 Egg  
 Spermatozoön  
 Gemmule  
 Sex  
 Embryology

Foetus  
 Epigenesis  
 Mitosis  
 Parthenogenesis  
 Alternation of Generations  
 Biogenesis  
 Cross-fertilization  
 Metamorphosis  
 Larva  
 Pupa  
 Metabolism  
 Growth  
 Regeneration  
 Heredity  
 Pangenesis  
 Prepotency  
 Telegony  
 Mendel's Law  
 Breeds and Breeding  
 Hybridity  
 Nidification

#### HABITS.

The habits of animals constitute the principal feature of what may be called Descriptive Zoology—that is, accounts of a species or a group of species placed under the vernacular name. This policy has been adopted, rather than that of putting descriptions under technical names, for greater convenience of reference, as well as to avoid that attitude of pedantry which made the earlier encyclopædias often ridiculous. The majority of readers would turn more naturally to HORSE than to “Equidæ” or to BLACKSNAKE than to “Zamenis.” The technical characteristics of many of the larger groups, lacking any English appellation, are given under their term in classification, as PROTOZOA, BOVIDÆ, and the like, or sometimes under the name of the special science dealing

with them, as ICHTHYOLOGY, ORNITHOLOGY. Habits of animals, then, may be learned from the descriptive articles generally, the principal of which are given below:

Agate Shell  
 Agouti  
 Albatross  
 Alewife  
 Alligator  
 Anaconda  
 Ani  
 Ant  
 Antelope  
 Ant-lion  
 Aoudad  
 Apteryx  
 Armadillo  
 Ass  
 Auk  
 Aurochs  
 Axolotl  
 Aye-aye  
 Baboon  
 Badger  
 Bandicoot  
 Bank swallow  
 Barn-owl  
 Barn-swallow  
 Bass  
 Bat  
 Bear  
 Beaver  
 Bedbug  
 Bee  
 Bighorn  
 Bird of Paradise  
 Bison  
 Bittern  
 Blackbird  
 Blacksnake  
 Bluebird  
 Bluefish  
 Boa

Bobolink  
Bollworm  
Bookworm  
Bot  
Bower-bird  
Brant  
Buffalo-bird  
Bug  
Bulbul  
Bumblebee  
Bunting  
Bushmaster  
Bustard  
Butterfish  
Butterflies  
Buzzard  
Caddis-fly  
Camel  
Capercaillie  
Capybara  
Caribou  
Carp  
Carpenter Bee  
Cat  
Cattle  
Cave Animals  
Cavy  
Chameleon  
Chamois  
Chinch-bug  
Cicada  
Civet  
Clam  
Clothes-moth  
Cockatoo  
Cockroach  
Cod  
Conch  
Condor  
Copperhead  
Cowbird  
Coyote  
Crab  
Cricket

Crocodile  
Crow  
Cuckoo  
Curlew  
Death Adder  
Deathwatch  
Deer  
Devilfish  
Dingo  
Dodo  
Dog  
Dove  
Dragon-fly  
Duck  
Duckbill  
Dugong  
Duiker  
Eagle  
Earthworm  
Eel  
Eider  
Elephant  
Electric Fish  
Ermine  
Falcon  
Fer-de-lance  
Firefly  
Fish-hawk  
Flamingo  
Flea  
Flesh-fly  
Fly  
Fly-catcher  
Flying Squirrel  
Fox  
Frog  
Gall-insects  
Gannet  
Garefowl  
Gazelle  
Gibbon  
Gipsy Moth  
Giraffe  
Gnat

Goat  
Goldfinch  
Goose  
Gopher  
Gorilla  
Goshawk  
Grayling  
Grebe  
Grouse  
Guanaco  
Gull  
Halibut  
Hare  
Hawk  
Hedgehog  
Hermit Crab  
Heron  
Herring  
Hessian Fly  
Hippopotamus  
Hognose  
Hook-worm  
Hornbill  
Horse  
Hound  
House-fly  
Humming-bird  
Hyena  
Ibex  
Ibis  
Iguana  
Jackal  
Jackdaw  
Jaguar  
Jay  
Jelly-fish  
Jungle Fowl  
Kangaroo  
Katydid  
King-bird  
Kingfish  
Kingfisher  
Kraken  
Lace-bug

Lamprey  
Land Tortoise  
Leech  
Lemming  
Lemur  
Leopard  
Lion  
Lizard  
Llama  
Lobster  
Lory  
Louse  
Lungfish  
Mackerel  
Mallard  
Mammalia  
Mammoth  
Manatee  
Man-eater Shark  
Marsh Hawk  
Marten  
Maskinonge  
Mastodon  
Menhaden  
Mole  
Mollusk  
Monkey  
Moose  
Mosquito  
Moth  
Mouse  
Mule Deer  
Mungoos  
Musk Ox  
Muskrat  
Narwhal  
Nest  
Nightingale  
Nightjar  
Nurse-frog  
Nutria  
Opossum  
Orang-utan  
Oriole

Ostrich	Sardine
Otter	Sawfish
Owl	Scale Insect
Oyster	Scorpion
Palolo Worm	Sea-anemone
Parrakeet	Sea-bass
Parrot	Sea-horse
Partridge	Seal
Peacock	Sea-otter
Pheasant	Sea-urchin
Pigeon	Shark
Pipa	Sheep
Pipefish	Sheepshead
Plant-bug	Shore-birds
Plover	Shrew
Polecat	Shrike
Pompano	Shrimp
Porcupine	Silkworm
Porpoise	Skunk
Potato Insects	Skylark
Prairie Dog	Sloth
Ptarmigan	Smelt
Puma	Snail
Python	Snake
Quagga	Snipe
Quail	Spaniel
Quinnat Salmon	Sparrow
Rabbit	Spider
Raccoon	Sponge
Rail	Sporozoa
Rat	Squid
Rattlesnake	Squirrel
Raven	Starfish
Ray	Stickleback
Rhinoceros	Stork
Road-runner	Sturgeon
Robin	Sunfish
Rocky Mountain White Goat	Swallow
Roe Deer	Swan
Rook	Swift
Sable	Swine
Salamander	Tailor-bird
Salmon	Tanager
Sandpiper	Tapeworm

Tapir  
Tarantula  
Tautog  
Termite  
Terrapin  
Terrier  
Thread-worms  
Thrush  
Tick  
Tiger  
Tiger-hunting  
Tilefish  
Titmouse  
Toad  
Toucan  
Tree-frog  
Trogon  
Trout  
Tsetse-fly  
Turbot  
Turkey  
Turtle  
Umbrella-bird  
Vampire  
Veery  
Viper  
Vireo  
Viscacha  
Vulture  
Walrus  
Wapiti  
Warbler  
Wasp  
Watersnake  
Water-spider  
Water-thrush  
Wax-insect  
Weakfish  
Weasel  
Weaver-bird  
Weevil  
Whale  
Whippoorwill  
Wildcat

Wolf  
Woodpecker  
Wood-rat  
Worm  
Wren  
Yak  
Zebra

#### MIND IN ANIMALS.

The intelligence and mental processes of animals are subjects to which much attention has been paid recently, and facts bearing upon them are eagerly sought. Some of the conclusions of students will be found in the following:

Ant  
Nervous System, Evolution of the  
Habit  
Instinct  
  
Social Insects (under Insect)  
Orientation

#### DISTRIBUTION OF ANIMALS.

Everyone is aware that different parts of the earth's surface have different faunas, and that this condition apparently remains permanent, except when, by means of civilization or commerce, certain animals are enabled to spread beyond their natural habitat, and even become cosmopolitan, as have rats, house-mice, the European house-sparrow, and a large number of plant-feeding insects. Normally one fauna does not enlarge or diminish at the expense of another, and, for the most part, species of animals, as of plants, are restricted to a comparatively small range and set of climatic conditions. The local faunas, both on the land and in the sea, have been examined, and their boundaries well ascertained. It has been found, however, that groups of related faunas



exist side by side, which may be composed into large divisions called "subregions," and these into a few still larger ones called "regions." The natural barriers which are set to the dispersion of animals, and the finding of the actual boundaries of the faunal districts, form the outlines of the highly interesting study of the geographical distribution of animal life, past and present. To acquaint himself with this science, the reader should peruse the following co-related articles:

Distribution of Animals

Fauna

Ethiopian Region

Paleotropical Region

Holarctic Region

Nearctic Region

Oriental Region

Palaearctic Region

Deep-sea Exploration

Pelagic Animals

Plankton

See also the names of the various subregions, as NEW ZEALAND SUBREGION, MALAGASY SUBREGION, etc.; the paragraphs on *Fauna* under the names of the various continents and countries, as AMERICA, AUSTRALIA, BRAZIL, and the like; and, for the distribution of animals in past ages, PALEONTOLOGY, EXTINCTION OF SPECIES and MIGRATION OF ANIMALS.

#### RELATIONSHIP.

The relationship of animals toward others, and to the environment of each individual, species, or group, forms a feature of far-reaching importance and of great interest in zoology, and the study of the facts involved has been set apart as a science under the name of BIONOMICS. Much relating to it

will be found in the descriptive articles cited under Habits and elsewhere, but special consideration is given under the succeeding heads:

Bionomics

Cave Animals

Environment

Estivation

Flowers and Insects

Hibernation

Social Insects (under Insect)

Natural Selection

Orientation

Parasite

Symbiosis

Tropism

The relations between man and the lower animals are mainly those of warfare or service. Animals are in the way of his operations or dangerous to him, and must be got rid of, or supply him with flesh, or hide, or fur, or some other desirable thing, which can be obtained, in most cases, only by killing them; or they attract him to the chase and to such sports as angling and shooting. Hence, many are sought only to be killed, and some species have been entirely exterminated. On the other hand, his agricultural operations have encouraged the spread and development of some, as various insects, rats, etc., in a remarkable way. A third class has been utilized by domestication and turned to his service and benefit. Some articles of special moment in the Encyclopædia dealing with this sporting and economic aspect of natural history are these:

Acclimatization

Angling

Bee

Buffalo

Domestic Animals (and the various kinds, as Camel, Cat, Dog, Horse, Sheep, Fowl, etc.)

Extinct Animals

Falconry

Fish as Food

Fish Culture

Fisheries

Fishing

Fur and the Fur Trade

Game Laws

Game Preserve

Insects, Propagation of Disease by

Introduced Species (especially of injurious insects, such as those described under Bollworm, Cutworm, Chinch-bug, Pear Insects, etc.)

Mosquito

Oyster

Pearl

Prairie Dog

Rabbit

Seal

Silkworm

Taxidermy

#### METHODS OF STUDY.

The methods of study in natural history are described to some extent in the articles:

Deep-sea Exploration

Laboratory

Microscope

Morphology

Nature-Study

Psychological Apparatus

Zoölogical Garden

Zoölogical Station

#### CLASSIFICATION OF ANIMALS.

Turning now from the methods and facts of observation and experiment to the philosophical deductions,—the principles and theories drawn from these

facts,—the reader will first need to attend to the subject of classification, which has been slowly developed through a long series of errors and limitations and gradually corrected in the brightening light of growing knowledge. The history of this search for the true, because natural, classification may be found in the articles ANATOMY, CLASSIFICATION OF ANIMALS, and ZOÖLOGY, with the names of the men who from time to time notably advanced taxonomy, and whose biographies may be read. No real success was achieved until the modern conviction was arrived at, that the key to the problem of classification was to be found in community of descent, and that any true classification must follow the perception of genetic relationship—descent from a common ancestor. This is the basis of modern classification, and what we have approaches perfection in just the degree that the phylogeny of each group is rightly apprehended. As a result of the constant increase of knowledge, the arrangement of this group and that is constantly being modified and presumably always improved. From time to time, these amendments are gathered up and critically combined into a general scheme. The latest such scheme of classification of the whole animal kingdom, which is authoritative and at the same time generally accessible, is that contained in Parker and Haskell's *Text-book of Zoölogy*, and this has been followed in respect to the general outline in this Encyclopædia, insuring uniformity. For further details, consult:

Classification of Animals

Phylogeny

## Variation

## Type

## Zoology

For the classification of separate groups, see their titles, as CœLENTERATA, CRUSTACEA, MOLLUSCA, ECHINODERMATA, etc.

## ZOOLOGY AND EVOLUTION.

The philosophical part of zoology has been developed since man began to observe the ways of nature, and has produced a vast body of "laws," doctrine, and speculation, the history of which is sketched in such general articles as ANATOMY, ZOÖLOGY, EVOLUTION, etc., and the biographies of the great thinkers cited should be read in connection with their themes. Science has constantly tended to separate itself from metaphysics, and to use its hypothesis merely as a means for further investigation of phenomena. The outcome has been the formulation and general acceptance of a theory of universal development from the simple to the complex, from the homogeneous to the specialized; and Organic Evolution or the Doctrine of Descent is the application of the general principle to the history and phenomena of living things. A reader who wishes to acquire a knowledge of these views of nature may do so by reading in consecutive order the articles named below:

## Biology

## Evolution

## Ontogeny

## Phylogeny

## Natural Selection

## Lamarckism

## Growth

## Heredity

## Hybridity

## Mendel's Law

## Extinction of Species

Guided by these articles and the cross-references to be found in them, he may pursue the subject under other fruitful titles, such as:

## Botany

## Chromosomes

## Cross-fertilization

## Degeneration as a Factor in Evolution

## Embryology

## Environment

## Flowers and Insects

## Isolation

## Kinetogenesis

## Longevity

## Mechanics of Development

## Mimicry

## Neo-Darwinism

## Neo-Lamarckism

## Otter Sheep

## Pollination

## Polymorphism

## Protective Coloration

## Recognition Marks

## Regeneration

## Reversion

## Senescence

## Sex

## Sexual Selection

## Use-Inheritance

## Variation

## Warning Coloration

## Weismannism

## BIOGRAPHY.

Only a name or two has been quoted in the preceding analysis of the science of zoology. The investigators in the field have been numerous, and the following list should be regarded as selected rather than complete. See:

Agassiz, L.

- Audubon, J. J.  
Baer, K. E.  
Baird, S. F.  
Balfour, F. M.  
Barry, M.  
Bates, H. W.  
Beecher, C. E.  
Bennett, J. H.  
Bichat, M. F. X.  
Blumenbach, J. F.  
Bory de Saint Vincent, J. B.  
Burbank, L.  
Burmeister, H.  
Camper, P.  
Carus, K. G.  
Castelnau, F.  
Clark, H. J.  
Cope, E. D.  
Coste, J. V.  
Cuvier, G. L. C.  
Dana, J. D.  
Darwin, C.  
Davenport, C. B.  
Degeer, K.  
Dohrn, A.  
Du Bois-Reymond, E. H.  
Dujardin, F.  
Eimer, T.  
Eschscholtz, J. F.  
Fleming, J.  
Flourens, M. J. P.  
Forel, A.  
Galton, F.  
Gay, C.  
Gegenbaur, K.  
Geoffroy Saint-Hilaire, E.  
Gesner, K.  
Goode, G. B.  
Gould, A. A.  
Gould, J.  
Graaf, R. de  
Green, S.  
Haeckel, E.  
Haller, A.  
Harvey, W.  
Hertwig, O.  
Hertwig, R.  
Huber, F.  
Humboldt, A.  
Hunter, J.  
Huxley, T. H.  
Hyatt, A.  
Jordan, D. S.  
Kölliker, A.  
Lamarck, J. B.  
Lang, A.  
Lankester, E. R.  
Le Conte, L.  
Le Conte, J. E.  
Le Conte, J. L.  
Leeuwenhoek, A.  
Leidy, J.  
Lesueur, C. A.  
Leuckart, R.  
Levaillant, F.  
Leydig, F.  
Linnæus, C.  
Loeb, J.  
Lubbock, J.  
Lyonnet, P.  
Malpighi, M.  
Marsh, O. C.  
Mendel, G. J.  
Mivart, St. George  
Müller, J.  
Müller, J. F. T.  
Orbigny, A. D. d'  
Osborn, H. F.  
Owen, Richard  
Packard, A. S.  
Pallas, P. S.  
Perty, J. A. M.  
Ray, J.  
Réaumur, R. A. F.  
Reimarus, H. S.  
Romanes, G. J.  
Ross, A. M.  
Roux, W.

Schleiden, M. J.  
Schultze, M. S.  
Schwann, T.  
Sedgwick, W. T.  
Semper, K.  
Siebold, K. T. E.  
Spallanzani, L.  
Spencer, H.

Swammerdam, J.  
Tschudi, J. J.  
Vries, H. de  
Wagner, M.  
Wallace, A. R.  
Weismann, A.  
Wilson, A.  
Wyman, J.

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## 28. Manufactures and Engineering

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**T**HE development of manufacturing industries has resulted from more efficient economic organization, and from the perfection of technological processes involving the application of scientific discoveries and knowledge. Accordingly, the most profitable method of study is first to consider the development of manufactures in general from the economic standpoint, and especially of the Factory System, where concentration permits of manufacture in increased quantities at diminished expense. This will be found treated in the articles on FACTORIES and MACHINERY, ECONOMIC EFFECTS OF, in which is traced the growth of manufacturing in general. For specific industries, reference should be made to the separate articles, as the historical and statistical development of any given industry is best considered by itself, on account of the important relation that it bears to practical questions of material, processes, and the like. This brings us straightway to the leading question how things are made, which it is an important function of an encyclopædia to answer. In this is involved the gathering and preparation of the raw material, the manufacture, the finishing, and the distribution, or utilization, of the finished product. There are prepared below a number of lists of subjects, more or less cognate, dealing with manufacturing industries and their products, and, by carefully observing the cross-references, a complete idea of the more important processes may be gained.

### A. Manufacturing Processes

#### FOOD AND MANUFACTURE OF FOOD STUFFS, ETC.

An important field of manufacturing operations is that concerned with the preparation of food stuffs, both in the factory and on a less extensive scale in the home. COOKERY; FOOD, PRESERVATION OF; SLAUGHTER HOUSES; and PACKING INDUSTRY are titles that suggest the wide range of subjects that may be grouped under such a head. The following list indicates appropriate titles:

Meat  
Slaughter Houses  
Packing Industry  
Food, Preservation of  
Digester

#### Extract of Meat

Ham  
Lard  
Tallow  
Pemican  
Jerked Beef  
Cookery  
Wheat  
Flour  
Baking  
Bread  
Biscuit  
Baking Powder  
Butter  
Cheese  
Guarana  
Macaroni  
Sugar  
Sardine

Gelatin  
 Confectionery  
 Chocolate  
 Cocoa Butter  
 Chewing Gum  
 Macaroon  
 Condiments  
 Pickles  
 Chutnee  
 Curry Powder  
 Olive Oil

#### FERMENTED AND DISTILLED LIQUORS.

The manufacture of BEER, WINE, and LIQUORS involves many interesting processes in chemical technology. A convenient beginning may be made by considering the history of fermented and distilled liquors, and the extent to which they are manufactured and consumed. Then, taking up the general properties of beer, wine, and distilled liquors, a classification of these beverages can be made, and the essential features of their production learned. Further details appropriate to the manufacture are discussed under BREWING, STILL, BOTTLING AND BOTTLING MACHINERY, while questions involving the chemistry of the subject are treated under FERMENTATION, DISTILLATION, and ALCOHOL. The physiological effects of alcohol are not only interesting, but instructive, and are properly considered in connection with the manufacture of alcoholic beverages. For a comprehensive study of the whole subject, the following articles should be consulted:

Liquors, Fermented and Distilled,  
 Statistics and History of  
 Alcohol  
 Alcoholometry  
 Hydrometer

Alcohol, Physiological and Poisonous Action of  
 Fermentation  
 Brewing  
 Beer  
 Wine  
 Currant Wine  
 Distilled Liquors, or Ardent Spirits  
 Distillation  
 Brandy  
 Apple Brandy  
 Rum  
 Whisky  
 Fusel Oil  
 Geneva  
 Gin  
 Liqueur  
 Absinthe  
 Benedictine  
 Chartreuse  
 Curaçoa  
 Kirsch  
 Kümmel  
 Maraschino  
 Ratafia  
 Noyau  
 Bishop  
 Cider  
 Berlin Spirit  
 Bottling and Bottling Machinery

#### FIBRES AND TEXTILES.

The subject of fibres and textiles is one of novel scope and, for its proper comprehension, requires first the consideration of the fibres themselves and how they are produced and prepared for manufacture. The chief vegetable fibres are:

Cotton  
 Flax  
 Hemp  
 Jute  
 Linen  
 Hemp, Manila

Ramie  
 Coir  
 Cotton, Artificial  
 Wood Pulp Yarns  
 Silk  
 Silk Worm  
 Floss Silk  
 Organzine  
 Wool  
 Wool and Worsted Manufactures  
 Sheep  
 Noils  
 Shoddy

It is next advisable to consider the processes by which the fibres are prepared for spinning and weaving. These processes are discussed in the following articles:

Cotton-Gin  
 Heckle  
 Carding  
 Spinning  
 Yarn

Textile manufacturing comprises industries of many diverse characters, which employ complicated machinery. As they have a certain amount of similarity, and bear some relation to each other, the processes of making the various fabrics may first be considered together. The first step is the designing of the fabric, in which the weaves, patterns, and designs are made on the LOOM. This naturally involves the discussion of WEAVING, which should explain the fundamental weaves and the methods by which patterns are produced. Therefore, in this connection, the following articles should be consulted:

Textile Manufacturing  
 Textile Designing  
 Weaving  
 Loom

Heddle  
 Bobbin

Crocheting and knitting differ essentially from weaving and, whether performed by hand or machine, are the means of producing garments and other useful articles. The following titles indicate the articles to be consulted on these subjects:

Crochet  
 Knitting  
 Hosiery

Either the yarn or the finished fabric may be dyed, or the latter may be printed, in order to impart colored designs to it. In either case, complex and interesting processes are involved, which are described in the list below:

Dyeing  
 Coal-Tar Colors  
 Vegetable Colors  
 Indigo  
 Turkey Red  
 Textile Printing  
 Beetling  
 Calendering  
 Bleaching  
 Bleaching-Powder  
 Embroidery

The finished textile fabrics are almost infinite in their variety. It is possible to select the more important and the representatives of the leading classes and study them in detail. Such a list arranged alphabetically is as follows:

Art Square  
 Bandana  
 Barege  
 Batiste  
 Blanket  
 Bobbinet



Bolting-Cloth  
Bombazine  
Brocade  
Brocatel  
Brussels Lace  
Buckram  
Bunting  
Cambric  
Camel's Hair  
Camlet  
Canvas  
Carpet  
Cassimere  
Chenille  
Chintz  
Corduroy  
Crape  
Cretonne  
Crinoline  
Damask  
Diaper  
Dimity  
Dornick  
Drugget  
Duck  
Felt  
Flannel  
Floor-Cloth  
Fustian  
Galloon  
Gauze  
Gingham  
Grass Cloth  
Gunny  
Haircloth  
Huckaback  
Kersey  
Lace  
Linen  
Matting  
Mercerized Cotton  
Mohair  
Moire  
Moleskin

Muslin  
Nankeen Cloth  
Nets  
Oilcloth  
Piña Cloth  
Plush  
Poplin  
Rugs  
Satin  
Silk  
Taffeta  
Tapestry  
Tarlatan  
Tweed  
Velvet

#### LEATHER AND LEATHER MANUFACTURES.

The various processes for the manufacture of LEATHER are described under that title, and the finished products, such as boots, shoes, saddlery, etc., in which independent industries participate, are appropriately grouped by themselves. For leather and leather goods, the following list is recommended:

Leather  
Bark  
Tanning (under Leather)  
Buckskin  
Glove  
Buff Leather  
Cordovan  
Shagreen  
Chamois  
Leather Cloth  
Saddlery  
Boot  
Shoes  
Blacking

#### CARRIAGES AND OTHER VEHICLES.

From the primitive ox-cart to the

modern motor vehicle in its numerous forms for business and pleasure is a long step, and it includes the development of many vehicles that have wrought important economic and social changes, involving new and improved road construction. These are represented in the following list:

- Cart
- Chariot
- Carriage
- Coach
- Driving
- Coupé
- Hansom Cab
- Wagonette
- Buckboard
- Phaeton
- Ambulance
- Bicycle
- Automobile
- Motor Vehicle
- Motor Cycle
- Side Car

#### CERAMIC INDUSTRIES.

Clay affords the fundamental material for numerous products used in industry and also for works of art. From its geology to its decorative application many interesting processes are involved, and the reader will find the subject well covered in the *NEW INTERNATIONAL ENCYCLOPAEDIA*. It is recommended that at the outset the article *CLAY* be studied, followed by those on the accompanying list which discuss rather the industrial uses as somewhat distinct from the mere artistic, as contained in the next following section:

- Clay
- Kaolin
- Kiln

- Fire Brick
- Fire Clay
- Pipe Clay
- Pottery
- Tile
- Terra Cotta
- Fireproof Construction

#### PORCELAIN AND POTTERY.

There are few more interesting studies than that of porcelain and pottery, and, if the processes are traced from the production of the clay until the finished piece emerges from the kiln after the final firing, the reader will be well repaid. For this purpose the following articles are recommended:

- Pottery
- Porcelain
- Biscuit
- Kiln
- Annealing
- Ceramic
- Enamel
- Bow China
- Burmese Ware
- Vase
- Cracklin
- Stoneware (under Delft)
- Delft Ware
- Eggshell China
- Faïence
- Jasper Ware
- Majolica
- Terra Cotta
- Tile
- Pyrometer

#### GLASS.

Few materials are more extensively employed in the arts than glass, and in scientific work and in decoration it also holds an important place. For the es-

essential features of its manufacture, the comprehensive and general article **GLASS** should be consulted, while the subordinate topics, as listed below, should be read in this connection:

- Glass
- Flint Glass
- Crown Glass
- Iridescent Glass
- Water-Glass
- Wire Glass (under Glass)
- Bottle
- Carboy
- Prince Rupert's Drops
- Bologna Vial
- Lens
- Mirror
- Lorraine Glass
- Stained Glass
- Gems, Imitation

#### HOROLOGY.

The construction of various instruments for keeping time is a science of considerable antiquity, and its various departments may be studied with profit. A convenient arrangement of titles is given below:

- Horology
- Clock
- Watch
- Clepsydra
- Dial
- Hour-Glass
- Balance
- Escapement
- Fusee
- Pendulum
- Isochronism
- Chronoscope
- Chronograph
- Time, Standard
- Time Signals

#### PRINTING, TYPOGRAPHY, ENGRAVING, PAPER, ETC.

The development of the art of printing has brought about many connected processes and industries. These are concerned with the impression on paper of letters or designs in one form or another, or the provision of the apparatus and machinery to do this, as well as the material to receive the impression. An arrangement of such subjects is as follows:

- Printing
- Case
- Type Founding
- Typesetting Machines
- Electrotyping (under Electro-Chemistry, Industrial)
- Bank Notes, Manufacture of
- Engraving
- Photo-Engraving
- Three-Color Process
- Lithography
- Rotogravure
- Ink
- India Ink
- Graphotype
- Paper
- Parchment
- Parchment, Vegetable
- Cardboard
- Bristol Board
- Cartridge-Paper
- Calendering
- Bookbinding
- Envelope
- Pen
- Fountain Pen (under Pen)
- Pencil
- Typewriters
- Copying Machines
- Sealing-Wax
- Ruling Machine

**MISCELLANEOUS INDUSTRIES AND PRODUCTS.**

Bead  
Bell  
Blacking  
Bristles  
Brush and Broom  
Button  
Candle  
Celluloid  
Coal-Tar  
Coke  
Comb  
Cooperage  
Cork  
Corset  
Cosmetics  
Doll  
Embossing  
Excelsior  
Fan  
Flowers, Artificial  
Gems, Imitation and Artificial  
Gilding  
Gimp  
Glove  
Glue  
Gold Lace  
Grease  
Gutta-Percha  
Ivory  
Ivory, Vegetable  
Japanning  
Jewelry  
Lac  
Lacquer-Work  
Lapidary Work  
Laundry Machinery  
Linoleum  
Lumber Industry  
Mangle  
Matches  
Needle  
Ormolu

**Papier-Maché**

Pen  
Pencil  
Perfumery  
Petrolatum  
Pin  
Poppy-seed Oil  
Pyrotechny  
Rope  
Rubber  
Sawdust  
Sewing Machine  
Silkworm Gut  
Straw Manufactures  
Tableware, Silver-Plated  
Tobacco Pipe  
Vacuum Cleaners  
Varnish  
Voting Machine

**MINING AND METALLURGY.**

In addition to general articles on **MINING AND METALLURGY**, there will be found, under the various metals, articles dealing not only with their occurrence and general properties, but also with their mining and metallurgy. Such articles are included in the following list:

Mining  
Metallurgy  
Iron and Steel  
Copper  
Gold  
Silver  
Nickel  
Zinc  
Platinum  
Lead  
Tin  
Antimony  
Manganese  
Mercury  
Aluminium

Cobalt  
Molybdenum  
Litanium  
Tungsten  
Uranium  
Vanadium

Damaskeening  
Brazing  
Rolling Mill  
Grinding and Crushing Machinery  
Mint  
Draw-Plate  
Electro-Plating  
Metal-Working Machinery

Looking, however, at special methods of mining and metallurgy, there are general articles which have reference to the more common metals and the methods of producing and refining them. These articles are as follows:

Mining  
Mines and Mining in Law  
Blasting  
Explosives  
Mine Accidents  
Assaying  
Metallurgy  
Metallography  
Calcining  
Crucible  
Ore Dressing  
Roasting  
Chloridizing  
Chlorination  
Refining of Metals  
Electro-Chemistry  
Electric Furnace

Although considerable material on metal working is given under the metals themselves, there are certain processes which can be described in special articles. These include the following:

Founding  
Forge, Forging  
Anvil  
Welding  
Tempering Steel  
Annealing  
Dies and Die-Sinking

For many purposes, alloys are more useful than simple metals. These are discussed under their own heads, as well as in a collective article, while other preparations of metal, as GALVANIZED IRON and STEEL WOOL are also treated. A list of such articles is as follows:

Alloy  
Alloys Magnetic  
Brass  
Bronze  
Babbitt Metal  
Fusible Metal  
Coinage  
Pinchbeck  
Solder  
Flux  
Galvanized Iron  
Steel Wool

The ornamental working of metals into small objects is also to be considered, and there are a number of articles which treat the subject from the artistic as well as the practical side. These titles include:

Jewelry  
Plate, Sheffield  
Tableware, Silver-Plated  
Gold-Beating  
Gold-Beater's Skin  
Repousée  
Enamel  
Embossing

## B. Construction

### BUILDING AND BUILDING MATERIALS.

The materials used in building embrace natural and artificial substances which are specially wrought for the purpose. Whether we start with the lumber from the forest or the stone of the quarry, we find that there are a number of processes which have to be gone through before the material is finally disposed of in its appointed place. Considering first the materials for building, together with their sources, the following list has been constructed:

- Building-Stone
- Quarry, Quarrying
- Stone Cutting and Dressing
- Stone, Artificial
- Clay
- Brick
- Mortar
- Kiln
- Cement
- Concrete
- Terra Cotta
- Tile
- Gypsum
- Lumber Industry
- Factor of Safety
- Strength of Materials

For a study of the process of BUILDING, the article under that title will furnish an adequate idea. The separate branches, however, require more extensive treatment, as the following topics will suggest:

- Building
- Carpentry
- Cabinet Work
- Foundation

- Masonry
- Brick Work
- Fireproof Construction
- Steel Skeleton Construction
- Half Timber
- Plaster, Lathing and Plastering
- Heating and Ventilation
- Plumbing
- Elevator
- Paper-Hangings
- Painting
- Illumination
- Gas, Illuminating and Fuel
- Electric Lighting

For certain forms of building, such as APARTMENT HOUSES and HOTELS, somewhat different equipment is required, and these are discussed under their own heads. For building operations in general, there are a number of minor topics that require a separate treatment. These may be included in the following list:

- Centring
- Chimney
- Door
- Window
- Framing
- Column
- Girder
- Beam
- Brace
- Roof
- Gutter
- Lightning, Protection from
- Lock
- Alarm
- Fire-Escape
- Calcimine
- Heating and Ventilation

## C. Engineering

The constantly broadening field of engineering endeavor has resulted in dividing the work, so that to-day an engineer adopts but a comparatively small field for his own activity. Under **ENGINEER AND ENGINEERING** will be found a description of the modern divisions of engineering work and the qualifications of the men that follow each branch. In civil engineering, first may be mentioned the surveyor.

### SURVEYOR.

Surveying involves the measurement of distances and areas and the delineation of the territory examined. It is carried on in different ways, depending on the extent and character of the country under survey. The following shows the general division of topics:

- Surveying
- Coast and Geodetic Survey
- Geological Survey
- Geodesy
- Triangulation
- Isostasy
- Deflection of the Plumb Line
- Hydrography
- Dredge
- Sound, Sounding
- Photographic Surveying
- Altimetry
- Hypsometry
- Leveling
- Offset
- Map
- Engineering Instruments
- Theodolite
- Plane-Table
- Stadia
- Telemeter
- Vernier

- Sextant
- Compass, Solar
- Planimeter
- Range-Finder
- Aneroid
- Heliograph
- Odometer

### RAILWAYS.

After a general and comprehensive review of the subject of **RAILWAYS** in the article of that title, particular parts require somewhat fuller treatment, involving, as they do, engineering and other features of a unique character. For this purpose, the following list is supplied:

- Railways
- Street Railway
- Urban Railways
- Electric Railways
- Ship Railway
- Locomotive
- Compressed-Air Locomotive
- Tunnel
- Bridge
- Cantilever
- Viaduct
- Culvert
- Gauge
- Frog, Railway
- Fish Plate
- Block-Signal System
- Air Brake
- Buffer, Buffing Apparatus
- Bumping Posts
- Snow-Plow

### RIVER AND HARBOR IMPROVEMENTS.

Various important works to aid maritime commerce consist in the erection of numerous harbor and river im-

provements. These are of a permanent character and require special engineering. Such works are described in the list below:

- Lighthouse
- Buoy
- Jetty
- Breakwater
- Embankments
- Cofferdam
- Foundation
- Dike
- Harbor
- Dredge
- Levee
- Dock
- Pile
- Excavating Machinery
- Blasting
- Caisson
- Masonry
- Retaining Walls
- Quay

#### CANALS.

When canals are carried across an isthmus, as at Suez or Panama, they may involve also many of the essential characteristics of harbor improvements; yet such works show considerable variation, and, when ordinary inland canals or those in connection with an irrigation system are considered, the methods of construction are quite different. The following list suggests a line of topics that could with profit be consulted:

- Canal
- Irrigation
- Panama Canal
- Nicaragua Canal
- Suez Canal
- Corinth Canal
- Erie Canal

- New York State Barge Canal
- Cape Cod Canal
- Saint Mary's Canal
- Welland Canal
- Chicago Drainage Canal
- Trans-Isthmian Canal
- Ship Railway

#### WATERWORKS AND HYDRAULIC ENGINEERING.

The use of water practically involves a separate department of engineering, but one in contact at many points with civil, sanitary, mechanical, and electrical engineering. It is necessary first to consider WATER SUPPLY, or the sources of water, then its storage, transmission, purification, distribution, and final consumption, and also various devices that are employed in these different stages. The material on this subject in the *New International Encyclopædia* is represented in the following list:

- Water Supply
- Hydrography
- Well-Sinking
- Artesian Wells
- Dams and Reservoirs
- Hydrostatics
- Hydrodynamics
- Current-Meter
- Weir
- Irrigation
- Pipe
- Water Purification
- Water-Works
- Fire Protection
- Pumps and Pumping Machinery
- Valve
- Water Power
- Filter and Filtration
- Accumulators
- Hydraulic Ram
- Water Wheel and Turbines



Hydraulic Press  
 Archimedes' Screw  
 Danaide  
 Hydraulic Pressure Engine  
 Water Meters  
 Hydraulic Elevator (under Elevator)

#### SANITARY SCIENCE.

Under this somewhat comprehensive title, may be included such schemes as tend to improve and safeguard the health of mankind. See:

Hygiene  
 Diet  
 Occupational Diseases  
 Schools, Medical Inspection of  
 Health, Boards of  
 Sanitary Commission  
 Sanitary Laws  
 Quarantine  
 Water Supply  
 Water-Works  
 Water Purification  
 Plumbing  
 Garbage and Refuse Disposal  
 Sewage Disposal  
 Sewerage  
 Disinfectants  
 Drainage  
 Catch-Drains  
 Heating and Ventilation  
 Bath-Houses, Municipal  
 Slaughter Houses  
 Burial  
 Cemetery  
 Cremation of the Dead  
 Health Association, American Public

#### MUNICIPAL ENGINEERING.

The various applications of engineering knowledge to a large city result in the solving of many problems, such as water supply, transportation, the

provision of PARKS and PLAYGROUNDS for the masses, etc., and especially the fundamental ones involved in CITY PLANNING, which are now engrossing the attention of many American cities. These subjects, grouped from this point of view, will be found in the following list:

City Planning  
 Road  
 Street  
 Boulevard  
 Road and Street Machinery  
 Asphalt  
 Pavement  
 Subways  
 Electric Railways  
 Street Railways  
 Urban Transportation  
 Water-Works  
 Illumination  
 Electric Lighting  
 Parks and Playgrounds  
 Landscape Gardening  
 Recreation Piers  
 Bath-Houses, Municipal  
 Garbage and Refuse Disposal  
 Municipal Ownership  
 Public Utilities

See also preceding section on Sanitary Science.

#### FIRE PROTECTION.

The surest fire protection is FIRE-PROOF CONSTRUCTION for buildings, seen at its best in STEEL SKELETON CONSTRUCTION, where combustible material is reduced to a minimum. Then there are SAFES AND SAFE DEPOSIT VAULTS for valuables, and the use of INCOMBUSTIBLE FABRICS. When these safeguards are unavailing, however, recourse must be had to the various apparatus for fighting fire, such as the

**FIRE-ENGINE**, now seen in its self-propelled form, the motor fire-engine, the high pressure pumping service, the **FIRE-EXTINGUISHER**, etc. See:

- Fireproof Construction
- Safes and Safe Deposit Vaults
- Fireproofing
- Incombustible Fabrics
- Fire-Alarm
- Fire Protection, Municipal
- Fire-Engine
- Fire-Extinguisher

#### **MECHANICAL ENGINEERING.**

For raising and transporting materials, and for carrying on other important operations, many interesting mechanical devices are constructed. The **CABLEWAY**, **TELPHERAGE**, **DERRICK**, and **TRAVELING SIDEWALK** are typical of the former class, while **GRINDING AND CRUSHING MACHINERY** and **AIR COMPRESSOR** may be cited as divisions of the many branches of mechanical engineering. A list of such subjects as are not already cited under other heads includes:

- Derrick
- Crane
- Cableway
- Telpherage
- Ropeway
- Traveling Sidewalk
- Elevator
- Air Compressor
- Blowing-Machines
- Pneumatic Dispatch
- Power, Transmission of
- Dynamometer
- Brake
- Prony Brake
- Air Brake
- Lubricants
- Wood-Working Machinery

#### **MECHANICAL DEVICES.**

In the construction of machinery there are certain elementary parts that enter into its design. These serve such purposes as changing the direction of a motion, increasing or reducing speed, or permitting its control in any desired way. See:

##### **Mechanical Powers**

- Axle
- Shafting
- Wheel and Axle
- Lever
- Pulley
- Crank
- Cam
- Eccentric
- Winch
- Windlass
- Inclined Plane
- Wedge
- Toggle Joint
- Screw
- Endless Screw
- Belt
- Gear-Wheel
- Gearing
- Couple

#### **PRIME MOVERS.**

For the generation of power there are a number of sources to be considered. **HEAT**, **STEAM**, **ELECTRICITY**, **WATER POWER**, **WIND**, etc., are all treated in their proper places, but under this head may conveniently be included articles describing the means for transforming energy into mechanical power available for a thousand and one different purposes. See:

- Hot-Air Engine
- Compressed-Air Engine
- Compressed-Air Locomotive
- Gas-Engines

**Internal-Combustive Engines.**

Motor Vehicle  
 Fireless Engine  
 Steam Engine  
 Steam Turbine  
 Water Wheel  
 Windmill  
 Hydraulic Ram  
 Hydraulic Press  
 Hydraulic-Pressure Engine  
 Dynamo-Electric Machinery  
 Mechanical Powers

**STEAM AND STEAM ENGINE.**

Commencing with a consideration of the properties of steam, any discussion soon reaches the **STEAM ENGINE** and its various parts and its applications. Such will be found in the classification given below:

Steam  
 Boiler  
 Economizers  
 Shaking Grates  
 Æolipile  
 Steam Engine  
 Locomotive  
 Steam Navigation  
 Steam Turbine  
 Pumps and Pumping Machinery  
 Eccentric  
 Crank  
 Fly-Wheel  
 Governor  
 Valve  
 Injector  
 Indicator  
 Safety Valve  
 Condenser  
 Horse-Power

**ELECTRICAL ENGINEERING.**

In Electrical Engineering, we may include the generation and distribution

of electric current, also its use for light and power, and the methods by which it is transmitted to considerable distance. The subject is treated in the following articles:

Dynamo-Electric Machinery  
 Armature  
 Cable, Electric  
 Transformer  
 Synchronizer  
 Transmission of Power  
 Electric Lighting  
 Electric Furnace  
 Electric Heater  
 Electric Railways  
 Urban Transportation  
 Electro-Chemistry  
 Storage Battery  
 Electrolysis  
 Welding  
 Lightning-Arresters  
 Electric Fuze (under Fuze)

For a discussion of the phenomena of the electric current, see the comprehensive section on Electricity in the chapter on Physics.

**TOOLS.**

Many and varied tools have been and are used by the mechanic, which are discussed in the articles dealing with the various industries. Certain groups and individual tools, however, demand consideration. Thus, **METAL** and **WOOD-WORKING MACHINERY** include many important tools, the chief types of which it is desirable to understand. **PNEUMATIC TOOLS** have resulted in considerable saving of labor and are of increasing importance. Many tools, such as the file, hammer, and axe, still survive and are not yet

replaced by machinery. The list in alphabetical order is as follows:

Axe  
Boring Machinery  
Calipers  
Cutlery  
Drill  
File  
Hammer  
Jack  
Mandril  
Marlinespike  
Metal-Working Machinery  
Micrometer  
Plane  
Pneumatic Tools  
Sand Blast  
Sandpaper  
Saw  
Sawmill  
Screw  
Wood-Working Machinery

#### **TELEGRAPH AND TELEPHONE.**

The transmission of intelligence is constantly being accomplished more effectively and by a greater variety of methods, specialization having its play here as in other branches of applied electricity. The following articles may be recommended as supplying a complete idea of the history and development of these important processes:

Telegraph  
Signaling and Telegraphing, Military  
Lightning-Arresters  
Telautograph  
Telegraphy, Submarine  
Atlantic Telegraph  
Wireless Telegraphy  
Telephony  
Coherer  
Telephone

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# Chapter 19. Efficiency and Industrial Management

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**W**HILE few terms have been more abused in recent years than the word "Efficiency," which may be interpreted all the way from implying some occult science for making two blades of grass grow where one or even less previously flourished, to some simple means for securing greater output of a factory or business, it may be understood, however, in its strictly technical sense, as the ratio of the actual to the possible, or output to input. In such studies are involved much that can result and be interpreted to the advantage of mankind, so that in mathematical language a condition will be realized where this ratio will approach nearer to unity. For true efficiency there must be a knowledge both of the actual and the possible, expressed exactly and quantitatively, and then the employment of various means to eliminate waste and lost motion, so that the enterprise shall be more productive and yield greater returns, both gross and net. To accomplish this there are various methods, differing as to their manner and as to the claims advanced for their merits and workability, yet essentially the same if examined as regards their psychological and philosophical fundamentals.

Accordingly, when one investigates the subject of SCIENTIFIC MANAGEMENT he must first learn its objects and then appreciate wherein it is scientific, and then determine the various methods and schools of thought that have developed to secure these objects. Therefore, the student in this field should consult the fundamental articles on EFFICIENCY and INDUSTRIAL MANAGEMENT, but he will find also that in addition he will be required to inform himself as regards BOOKKEEPING and ACCOUNTING, for all studies in this field must depend upon records and bear a relation to the final system of accounts and values that show the profit of the enterprise. Accordingly, one might suggest the following list of titles that develop this interesting field of modern thought:

Efficiency  
Industrial Management  
Scientific Management  
Legislative Management  
Premium Plant  
Motion Study  
Time Study  
Task and Bonus  
Unit System

The articles BOOKKEEPING and ACCOUNTING, previously mentioned, should be read and also that on RAILWAYS, where, in the case of American railways, there has been much dispute as to the degree of efficiency that is secured in their operation, the principles of scientific management being designed to find application here if anywhere.

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## 30. Military and Naval Science

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**A**S the purpose of an army or any military organization is to carry on, or at least be prepared to carry on, war, either of defense or of offense, as effectively as possible, a study of the topic WAR, to ascertain under what circumstances recourse is had to the court of arms and under what conditions the laws and usages of nations demand that war shall be waged, makes a fitting beginning for reading in this field. Then, coming to the actual operations of war, we find that they must be planned according to the principles of STRATEGY and executed along lines worked out in systems of TACTICS. Accordingly, then, a suitable grouping of allied subjects is as follows:

### A. Armies

War  
Strategy  
Tactics, Military  
Military Aëronautics  
Attack  
Assault  
Fire  
Battle  
Engagement  
Skirmish  
Invasion  
Blockade  
Fortifications, Attack and Defense of  
Siege  
Sap  
Bombardment  
Coast Defense  
Manœuvres  
Evolutions, Military  
Demonstration  
Marching  
Manual of Arms  
À Cheval Position  
Ambuscade  
Ambush  
Debouching  
Échelon  
Enfilade  
Feint

Point d'Appui  
Retreat  
Base of Operations  
Advance Guard  
Cavalry Screen  
Outposts  
Picket  
Patrol  
Guard  
Main Guard  
Rear Guard  
Flank  
Reconnaissance  
Prisoner  
Contraband of War

#### ORGANIZATION.

To carry out, however, any scheme of strategy and tactics involves an army whose effectiveness depends upon its organization. In the organization of an army, the INFANTRY, CAVALRY, and ARTILLERY, or LINE, must be considered. These are its prime essentials, together with its ENGINEERS, MEDICAL DEPARTMENT, COMMISSARIAT, Department of the QUARTERMASTER, SIGNAL CORPS, Bureau of Military Justice, or Judge Advocate's Department, its Pay Corps, GENERAL STAFF, and the vari-

ous other bureaus and departments upon the efficiency of which the successful organization and operation of a military body depend.

Looking at military organization from the point of view of the units of which an army is made up, we may start with the CORPS, and gradually proceed from one command to an inferior one, learning the function of each and its relation to the common whole. RANK AND COMMAND is the keystone of military organization. Over each body of men there must be an appropriate officer, and to learn his duties it is but necessary to consult the article on this subject. In addition to officers, there may be certain subordinate individuals who have peculiar or individual functions to perform; these too are best described under their own heads. The accompanying lists suggest the relation of many of these topics. Dealing first with the division which may be headed Armies and Army Organization, we find large and adequate treatment, the historical side here as well as elsewhere in the Encyclopædia being considered. The first group deals with the divisions of military organization, the second, entitled RANK AND COMMAND, with the individuals of all ranks that form an army. See:

(a) *Armies and Army Organization:*

Army Organization  
Armies  
Corps  
Division  
Brigade  
Regiment  
Battalion  
Squadron  
Company

Battery  
Platoon  
Detachment  
Artillery  
Artillery Corps  
Artillery Train  
Cavalry  
Infantry  
Mounted Infantry  
Engineer Corps  
Medical Department, United States Army  
Medical Department, United States Navy  
Ambulance  
Hospital Corps  
Signal Corps  
General Staff  
Staff  
Military Police  
Band, Military  
Pioneer  
Sharpshooter  
Color-Guard  
Reserve  
Cadre  
Contingent  
Column  
Militia  
Landwehr  
War, Department of  
Horse Guards  
Life Guards  
United States Army (under United States)

(b) *Rank and Command:*

Field-Marshal  
General  
Lieutenant-General  
Major-General  
Brigadier-General  
Colonel  
Lieutenant-Colonel

Major  
Captain  
Lieutenant  
Cadet, Military  
Cadet, Naval  
Adjutant-General  
Adjutant  
Aide-de-Camp  
Commissary  
Quartermaster  
Paymaster  
Surgeon, Military  
Inspector-General  
Chaplain  
Contract Surgeon  
Commander-in-Chief  
Commandant  
Field Officer  
Ensign  
Cornet  
Non-Commissioned Officer  
Color-Sergeant  
Drum Major  
Sergeant  
Corporal  
Gunner  
Artificer  
Drummer  
Orderly  
Private  
Bombardier  
Sentinel

#### MILITARY ENGINEERING.

To the military engineer are assigned many problems connected with the existence and operation of an army. He has to provide for its protection in both peace and war, which involves the construction of suitable barracks, camps, and fortifications, both temporary and permanent, and is besides required to study and delineate the country in which the troops live or operate.

Naturally, the chief division to be made in the topics relating to this subject is **FORTIFICATION**, involving the construction of more or less permanent works, and **Field Engineering**, dealing with those of a more temporary character. See:

Engineering, Military  
Fortification  
Military Architecture  
Battery  
Bastion  
Berm  
Blockhouse  
Caponiere  
Casemate  
Coast Defense  
Embrasure  
Epaulement  
Traverse  
Stockade  
Enceinte  
Frontier, Military  
Trench, Military  
Escarp  
Gallery  
Magazine  
Martello Tower  
Orillon  
Abatis  
Bill-Hook  
Blindage  
Barricade  
Cheveaux-de-Frise  
Fascines  
Gabion  
Approaches  
Parallels  
Siege and Siege Works  
Demolition  
Breach  
Camp  
Bridges and Docks, Military  
Mines and Mining, Military



Redoubt  
Retrenchment  
Revetment  
Redan

#### FORTS OF THE UNITED STATES.

With a description of the principles of Fortification and Military Encampments, or posts, may properly be included a description of such military posts of the United States as are of importance for one reason or another. These are included in the following list, and the articles give information as to their location, garrison, general characteristics, etc.

Fort Adams  
Fort Bliss  
Fort Canby  
Fort Caswell  
Fort Clark  
Fort D. A. Russell  
Fort Douglas  
Fort Du Pont  
Fort Ethan Allen  
Fort Flagler  
Fort Grant  
Fort Greble  
Fort Hamilton  
Fort Hancock  
Fort Howard  
Fort Jay  
Fort Keogh  
Fort Leavenworth  
Fort Logan  
Fort McHenry  
Fort McPherson  
Fort Meade  
Fort Monroe  
Fort Morgan  
Fort Myer  
Fort Porter  
Fort Preble  
Fort Riley

Fort Robinson  
Fort Sam Houston  
Fort Schuyler  
Fort Sheridan  
Fort Snelling  
Fort Stevens  
Fort Strong  
Fort Terry  
Fort Thomas  
Fort Totten  
Fort Trumbull  
Fort Wadsworth  
Fort Warren  
Fort Washington  
Fort Wayne  
Fort William H. Seward  
Fort Yellowstone  
Columbus Barracks  
Jefferson Barracks  
Madison Barracks  
Plattsburg Barracks  
San Diego Barracks  
Vancouver Barracks  
Washington Barracks

#### ORDNANCE AND GUNNERY.

To carry on warfare, many weapons and resources have been placed at the disposal of the soldier. Such titles as ARTILLERY, ORDNANCE, EXPLOSIVES, AÉROPLANES, SUBMARINES, GUNPOWDER, PROJECTILES, SMALL ARMS, naturally suggest themselves as principal topics. With them may be grouped the underlying science as embodied in BALLISTICS and GUNNERY, together with the other topics contained in the following list:

##### (a) *Artillery:*

Coast Artillery  
Field Artillery  
Horse Artillery  
Mountain Artillery

Siege Gun  
Guns, Naval  
Rapid-fire Guns  
Machine Gun  
Mitrailleuse  
Gardner Gun  
Mortar  
Howitzer  
Air Gun  
Pneumatic Gun  
Submarine Gun  
Ordnance  
Ordnance Establishments  
Cannon  
Jacket  
Bore  
Calibre  
Artillery Carriages  
Gun-Carriage  
Limber  
Caisson  
Small Arms  
Carbine  
Chassepôt  
Arquebus  
Bayonet  
Pistol  
Revolver  
Target and Target Practice  
Sword

(b) *Projectiles:*

Ammunition  
Grape-Shot  
Case-Shot  
Canister  
Carcass  
Grenade  
Bomb  
Shrapnel  
Rocket  
Cartridge  
Torpedo

(c) *Explosives:*

Gunpowder  
Smokeless Powder  
Dynamite  
Nitroglycerin  
Atlas Powder  
Cordite  
Lyddite  
Maximite  
Picric Acid  
Dualine  
Fulminates  
Fulminate of Mercury  
Fulminate of Silver  
Pyrotechny  
Primer  
Fuze  
Greek Fire  
Charge  
Matches

(d) *Gunnery:*

Ballistics  
Range  
Range-Finder  
Aim  
Charge  
Plongée  
Ricochet  
Target and Target Practice  
Target Practice, Naval  
Proving Ground  
Loading-Tray

(e) *Historic Cannon:*

Coehoorn  
Columbiad  
Demi-Cannon  
Demi-Culverin  
Falcon  
Jingal  
Mitrailleuse

UNIFORM AND EQUIPMENT.

Closely connected with the soldier's

and sailor's weapons are his Uniform and Equipment, the various insignia often being matters of considerable interest and curiosity to the layman. With these subjects, we may include allied topics as follows:

#### Military Insignia

Uniforms, Military and Naval

Aiguillettes

Bandolier

Busby

Canteen

Cartouch

Chevrons

Epaulet

Facings

Good Conduct Badges

Haversack

Helmet

Képi

Khaki

Kit

Knapsack

Spur

Sword

#### MILITARY CEREMONIES.

As a witness of various military ceremonies or other formalities, the layman comes in contact with certain other aspects of army and navy life. The more important of these will be treated under their respective heads. See the following:

Salutes

Feu-de-Joie

Dress Ship

Escort

Review

Inspection

Parade

Muster

#### FLAGS.

Flags of one kind or another, by rea-

son of their histories and tradition and their special uses at the present time, play an important part in military and naval affairs. Besides being the emblem of the nation, they may also pertain to various organizations or individuals, as the colors of a regiment or the flag of an admiral. These will be understood on reference to the following articles, many of which are illustrated by colored plates:

Flag

Ensign

Colors

Guidon

Standard

Pennant

Jack

Union Jack

Flag of Truce

Signaling and Telegraphing

#### HISTORIC AND SPECIAL MILITARY ORGANIZATIONS.

Military organizations in the past, as well as in the present, have been formed either for special purposes or under special auspices, or as independent commands. Some of the more famous classes of soldiers and historic military organizations are those included in the following list:

Artillery Company, Ancient and Honorable

Artillery Company, Honorable

Bashi-Bazouks

Beefeater

Bersaglieri

Black Watch

Cameronians

Carbineers

Chasseurs

Cohort

Coldstream Guards

Colonial Corps  
Cossacks  
Cuirassier  
Dragoons (under Cavalry)  
Equestrian Order  
Fencible  
Foot Guards  
Francs-Tireurs  
Fusiliers  
Green Mountain Boys  
Grenadier  
Grenadier Guards  
Guard  
Guerrillas  
Guide  
Gurkhas  
Highlanders  
Honvéd  
Horse Guards  
Household Troops  
Hussars  
Janizaries  
Lancer  
Landsturm  
Landwehr  
Legion  
Life Guards  
Mamelukes  
Minute Men  
Mobiles, Corps of  
National Guard  
Phalanx  
Rangers, Mounted  
Rifleman  
Rough Riders Association  
Scots Greys  
Sepoy  
Sikhs  
Spahis  
Streletsi  
Trainbands  
Voltigeurs  
Yeomanry  
Yeomen of the Guard

Zouaves

#### MILITARY LAW.

For the government of the army there are certain statutes and regulations. International law in many of its aspects touches on the acts of armies in the field. Accordingly, a grouping of certain topics allied, though not necessarily logically connected, may be made as follows:

Military Law  
Acts of Hostility  
Allegiance  
Armistice  
Articles of War  
Belligerent  
Blockade  
Booty  
Bounty  
Capitulation  
Cartel  
Cashiering  
Casus Belli  
Conscription  
Contraband of War  
Council of War  
Courts Military  
Declaration of War  
Desertion  
Discharge  
Judge-Advocate  
Judge-Advocate-General  
King's Regulations  
Martial Law  
Military Commissions  
Military Government  
Military Law  
Military Police  
Military Prison  
Neutrality  
Posse Comitatus  
Prisoner  
Privateering

Prize  
Prize Courts  
Provost-Marshal  
Ransom  
Spy  
Truce  
War

#### MILITARY AND NAVAL EDUCATION.

The professions of the soldier and sailor require from beginning to end continual training, and from Academy to War College there are many studies to be pursued. Grouping those topics referring to the education of the soldier and sailor, we have the following list:

Army Schools  
Artillery Schools  
Cadet, Military, Naval  
Military Geography  
Cavalry and Light Artillery School  
Military Education  
Military Academy, U. S.  
General Service and Staff College  
Staff Colleges and Schools  
War College  
Naval Academy, U. S.  
Naval Schools of Instruction  
Naval Institute, U. S.  
Discipline  
Drill  
Drill Regulations

#### MISCELLANEOUS.

The food for the soldier and his animals is discussed under RATIONS and FORAGE, and its mode of preparation

under FIELD COOKING. The principal BUGLE AND TRUMPET CALLS that summon him to his duties are given with the music notes, and the DRUM and FIFE, which supply the field music, are also treated. Methods of RECRUITMENT in various countries, and also RETIREMENT, should be studied, while the PAY AND ALLOWANCES of the soldier must be considered in order to understand army conditions at home and abroad. An essential of modern military operations is the maintenance of communication between every part of an army and its base, or capital. This is the function of the SIGNAL CORPS, whose operations and apparatus are treated under SIGNALING AND TELEGRAPHING, MILITARY. In the event of casualties, the SURGEON and the MEDICAL DEPARTMENT, with its HOSPITAL CORPS, are called into requisition, protected as they are by the terms of the GENEVA CONVENTION. It is advantageous to learn the present conditions of SURGERY, MILITARY, and the peculiar problems that the military surgeon has to face, as well as his methods of operation. In this connection, also, should be mentioned the work of the RED CROSS, and the part it plays in alleviating suffering on the battlefield. Of importance, as in a small way reproducing some of the conditions of warfare, the WAR GAME is worthy of consideration, as on its board may be worked out many interesting problems in strategy and tactics.

## *B. Ships and Navies*

No clearer distinction can be drawn in discussing vessels for navigating the seas than to consider separately those

for military purposes and those for commerce, but it is not always possible to make the separation complete,

and many subjects concerning nautical affairs cover or apply to both classes. Under NAVIES and SHIP AND SHIPPING (subhead *Ship, Armored*) are given historical accounts of the development of war craft, while the evolution of the merchant ship is traced under NAVIGATION, SHIPBUILDING, and SHIP AND SHIPPING (subhead *Power Navigation*). In the following lists the different kinds of warships, merchantmen, and boats which are separately described under their own titles are collected under the proper head:

(a) *Warships:*

Warship  
 Ship, Armored (subhead under Ship and Shipping)  
 Battleship  
 Cruiser  
 Fuel Ship  
 Gunboat  
 Torpedo Boat  
 Torpedo Boat, Submarine  
 Hospital Ship  
 Ram  
 Guard-Ship  
 Receiving Ship  
 Galley  
 Galliot  
 Trireme  
 Fire-Ship  
 Floating Battery  
 Frigate  
 Monitor  
 Mortar Vessel  
 Corvette

(b) *Merchantmen:*

Ship and Shipping and its various subheads  
 Power Navigation (subhead under Ship and Shipping)  
 Clipper

Bark  
 Brig  
 Schooner  
 Sloop  
 General Ship  
 Composite Ships  
 Lighter  
 Whaleback  
 Yacht  
 Lugger  
 Junk  
 Grab  
 Dhow  
 Corsair  
 Ketch  
 Pinnace  
 Pirogue  
 Pram  
 Great Eastern  
 Launch, Launching  
 Derelict  
 Wreck

(c) *Boats:*

Lifeboat  
 Life-Rafts  
 Balsa  
 Launch  
 Whaleboat  
 Long Boat  
 Jolly-Boat  
 Punt  
 Cutter  
 Catboat  
 Canoe  
 Catamaran  
 Banca  
 Ice-Breaking Steamer  
 Barca  
 Kayak  
 Ferry

NAVIES, NAVAL AFFAIRS, ETC.

There is included under this head, in the following lists, articles pertain-

ing not only to the navy proper, but to such government services as are connected with naval and nautical affairs, such as Coast Guard, Life-Saving Service, etc.:

*(a) Organization and General Subjects:*

Navies  
Tactics, Naval  
Marine Corps  
Engineer, Naval  
Medical Department, United States Navy  
Hydrographic Office  
Navy, Department of the  
Naval Academy  
Naval Schools of Instruction  
Naval College of Canada  
Revenue Cutter Service, United States  
Life-Saving Service  
Coast Guard  
Naval Reserve  
Crew  
Company, Ship's  
Complement  
Watch  
Division  
Landing Force  
Billet  
Mess  
Pay and Allowances  
Naval Reserve

*(b) Officers and Men:*

Admiral  
Commodore  
Captain  
Commander  
Lieutenant-Commander  
Lieutenant  
Ensign  
Midshipman  
Clerk, Paymaster's

Commanding Officer  
Commandant  
Flag-Officer  
Executive Officer, United States Navy  
Surgeon, Military and Naval  
Paymaster  
Watch Officer  
Naval Constructors  
Chaplain  
Provost-Marshal  
Pilot  
Warrant Officer  
Gunner  
Master  
Master-at-Arms  
Mate  
Carpenter, Navy  
Boatswain  
Machinist, Naval  
Petty Officer  
Quartermaster  
Coxswain  
Naval Apprentice  
Landsman  
Boys, Ships'

*(c) Naval Ordnance, Gunnery, Torpedoes, etc.:*

Guns, Naval  
Gunpowder  
Smokeless Powder  
Guncotton  
Rapid-fire Guns  
Machine Guns  
Target Practice  
Target  
Torpedo  
Torpedo Director  
Torpedo Net  
Rangefinder  
Stadimeter  
Projectile  
Mine, Submarine

*(d) Merchant Marine and Allied**Subjects:*

Navigation  
 Merchant Marine (of U. S.)  
 Ship and Shipping, subheads of:  
   Sailing Ship  
   Power Navigation  
   Classification of Ships for  
     Marine Insurance  
   Tables showing tonnage of  
     ships built and building in  
     the merchant navies of the  
     world  
 Great Eastern  
 Load-line Marks of Vessels  
 Measurement of Ships for Ton-  
   nage  
 Safety at Sea  
 Rules of the Road at Sea  
 Fog Signals  
 Coasting Trade  
 Trade, Board of  
 Trinity House  
 Crew  
 Master  
 Mate  
 Pilot

See also the titles grouped under Maritime Law and Navigation on subsequent pages.

## SHIPBUILDING AND NAVAL ARCHITECTURE.

The enormous size and great speed of many modern vessels require study, experience, and scientific attainments of the highest class for their design and construction. Under the head of SHIPBUILDING will be found a historical sketch of the subject, a description of the theory of design, of the means and methods of hull construction, and of the design, development, and construction of propelling and

other machinery. The principal titles under which shipbuilding information is to be found are:

Armor Plate  
 Ship and Shipping, and subheads  
 Shipbuilding, and subheads  
 Launch, Launching  
 Navigation  
 Load-line Marks of Vessels  
 Marine Engineering  
 Steam Engine  
 Steam Turbine  
 Boiler  
 Buoyancy  
 Stability  
 Metacentre  
 Resistance  
 Displacement  
 Tonnage  
 Measurement of Ships for Tonnage  
 Lloyds  
 A 1

The various parts of a vessel are almost infinite in number. The articles SHIPBUILDING and SHIP will tell of these various parts and describe how the skill of naval architect, marine engineer, and shipbuilder unites them into one congruous whole. Such parts, however, often possess distinct features and characteristics which need separate treatment, and these are included in the following list:

Beak  
 Bilge  
 Beam  
 Bottom  
 Bow  
 Bridge  
 Bulkhead  
 Bulwark  
 Cockpit  
 Cofferdam  
 Companion



Deck  
Figurehead  
Gangway  
Hawse  
Helm  
Hold  
Keel  
Keelson  
Paddle-Wheel  
Poop  
Screw Propeller  
Smokepipe

To gain a good idea of the rigging of a ship and the names of masts, sails, etc., the best plan is to consult the plate accompanying the article **SHIP**, where all the various parts of the rigging of a full-rigged ship are indicated and specified. There are various topics connected with sails and rigging that are described and their functions shown in brief articles. Such a list includes the following:

Belay  
Block  
Boom  
Bowsprit  
Brace  
Brail  
Bridle  
Burton  
Clip Hooks  
Cordage  
Crow's-Nest  
Davit  
Gaff  
Halliards  
Jib  
Jury  
Knotting and Splicing  
Lateen Sail  
Lug-Sail  
Mast

Purchase  
Rigging  
Sail  
Spanker  
Spinnaker  
Sprit  
Stay  
Tackle

Connected with the ship, but not wholly falling in any of the above classes, are many essentials such as the **ANCHOR**, the **BINNACLE**, the **DAVIT**, etc. These adjuncts are specially designed for specific purposes, which the reader naturally desires to understand. The following list includes some of the more important subjects in such a grouping:

Anchor  
Ballast  
Batten  
Bells  
Binnacle  
Block  
Boiler  
Boiler (under Shipbuilding)  
Bridle  
Buoy  
Burton  
Cable  
Canvas  
Capstan  
Cat  
Cofferdam  
Compass  
Controller  
Cordage  
Davit  
Fender  
Ground-Tackle  
Mooring Swivel  
Kedge  
Knotting and Splicing

Lifeboat  
Life Buoy  
Life-Preservers  
Life-Rafts  
Life-Saving Guns and Rockets  
Life-Saving Service  
Lights  
Marling Spike  
Oakum  
Purchase  
Rope  
Smokepipe  
Stopper  
Tackle  
Wheel  
Winch  
Windlass

Safety at Sea  
Rhumb Line  
Meridian  
Map  
Loxodrome  
Chart  
Hydrography  
Meteorology, Marine  
Sound, Sounding  
Coast Pilot  
Bowditch's Practical Navigator  
Almanac  
Nautical Almanac  
Ephemeris  
Pilot Chart  
Protractor  
Sextant  
Quadrant  
Vernier

#### NAVIGATION.

Navigation involves the conducting of a vessel from one port to another by making use of charts, the position of various heavenly bodies as determined by the navigator, and such other data as he can obtain by observation and calculation. In general this is contained in the article NAVIGATION, but further details and explanations are given of incidental topics. The following list will be found by the reader sufficiently comprehensive:

Navigation  
Latitude and Longitude  
Sailings  
Binnacle  
Compass  
Log  
Reckoning  
Dead Reckoning  
Day's Work  
Departure  
Deviation  
Fog Signals  
Rules of the Road at Sea

#### SEAMANSHIP.

Seamanship may be distinguished from navigation as dealing with the actual practice, rather than the theory, involving the handling of vessels and the means taken to insure their safety. Thus, under this head, is discussed such important subjects as the RULES OF THE ROAD, the use of the LOG, TACKING, jibing, mooring, and the various manœuvres and operations carried on at sea and in port. These hardly fall in a logical order, but the more important are contained in the following list:

Tacking and Wearing  
Jibe  
Boxhauling  
Lee  
Leeway  
Moor, Mooring  
Log  
Log-Book  
Helm

Steering  
 Port  
 Larboard  
 Starboard  
 Bearing  
 Sound, Sounding

#### MARITIME LAW.

Vessels sailing on the high seas are governed by rules and usages which have given rise to a body of laws known as admiralty and maritime law. Furthermore, such vessels are required to observe the statutes of the countries whose flags they fly, and such formalities as are duly prescribed. Connected with such governmental regulations are those of marine underwriters and insurance principles, forming a large department of maritime law. Interests at sea are also considered by international law, and prizes and privateering are subjects which it must consider. A grouping of interesting topics in these more or less related branches is as follows:

International Law  
 Admiralty Law  
 Maritime Law  
 Navigation Laws  
 Navigation, Freedom of  
 Ship's Papers  
 Manifest  
 Bill of Lading  
 Clearance  
 Bill of Health  
 Charter-Party  
 Cargo  
 Freight  
 Demurrage  
 Admiralty, The

Bounty  
 Collisions of Vessels  
 Bottomry Bond  
 Respondentia  
 Salvage  
 Derelict  
 Wharfage  
 Jettison  
 Barratry  
 Quarantine  
 Marine Insurance  
 Lloyds  
 A 1  
 Measurement of Ships for Tonnage  
 Tonnage  
 Load-line Marks of Vessels  
 Privateering  
 Prize  
 Prize Courts  
 Desertion  
 Safety at Sea

As the sailor must make his base of operations on shore, it is proper to consider such subjects as NAVY YARDS, DOCKS, etc., where he may secure supplies and protection. The following list indicates certain articles that will be of assistance in this respect:

Navy Yard  
 Dockyards, Royal  
 Arsenal  
 Reef  
 Harbor  
 Breakwater  
 Dock  
 Wharf  
 Torpedo Station  
 Naval Academy

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# Chapter 31. The Great War

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**T**HE WAR IN EUROPE is treated in an article that covers approximately the first two years of the war, and is a complete history of it in all its phases. It is divided into the following subdivisions: I, Underlying Causes; II, Outbreak of the War; III, Military Operations; IV, Naval Operations; V, Aërial Operations; VI, Alleged Atrocities in the War; VII, Destruction of Art and Architecture; VIII, Neutral Nations; IX, Relief Measures; X, Financial and Economic Aspects; XI, Bibliography. It is the purpose of this chapter to supplement the cross-references in the article itself, with a complete list of articles in the *NEW INTERNATIONAL ENCYCLOPÆDIA*, which deal directly or indirectly with the war.

On June 28, 1914, Archduke Francis Ferdinand, the Austrian heir apparent, was assassinated with his wife at Sarajevo, the capital of Bosnia. This was the match that touched off the conflagration which had been brewing in Europe for years. Austria-Hungary, accusing Serbia of complicity in the affair and declaring that it was the Serb aim to secure the provinces of Bosnia and Herzegovina, sent an ultimatum to Serbia on July 23. Serbia's reply, delivered just before the expiration of the time limit, only partially complied with Austria-Hungary's demands. Despite the most strenuous efforts on the part of the larger countries of Europe, Austria-Hungary declared war on Serbia on July 28. Russia, the champion of the Slav Balkan States, issued an order of mobilization and, upon the refusal to withdraw this order, Germany declared war on her. This turned all Europe into an armed camp. France and England came to the aid of Russia, and Germany stood by her ally, Austria-Hungary. Italy, claiming that her Alliance with Germany and Austria-Hungary was purely defensive and claiming further that Austria-Hungary's declaration of war on Serbia was offensive, refused to join her partners in the Triple Alliance. With the entrance of Rumania into the war in August, 1916, we find the following alignment of powers: Russia, France, England, Italy, Belgium, Japan, Serbia, Montenegro, Portugal, San Marino and Rumania opposed to Germany, Austria-Hungary, Bulgaria and Turkey.

## I. Underlying Causes

The Underlying Causes of the Great War fall naturally under three heads, namely: (1) National Antagonisms, (2) Militarism, and (3) Economic Rivalry.

### 1. NATIONAL ANTAGONISM.

The problem of national antagonism was an outgrowth of the Congress of Vienna, which concluded the French Revolution and Napoleonic periods. At this Congress many of the diplomats hoped that the principles of the French Revolution would be recognized and that the ruling ideas would be the recognition of the growth of democracy and the realization of national liberty. Because of the opposition of the reactionaries, particularly Metternich, these

ideas were subjugated and the attempt was made to restore the *ancient régime*. Thus we find the problem of nationality cropping up continually in the nineteenth century. Two examples of this will suffice to show the truth of this statement. As a result of the FRANCO-GERMAN WAR, Germany annexed Alsace and Lorraine, French-speaking territories. At the CONGRESS OF BERLIN, Russia's hopes of making the Balkan peninsula a Slav sphere of influence were frustrated by the jealousy of the other European powers. The French consequently hoped for the day of restoration and the national awaking of Russia foreshadowed her expansion to the Mediterranean. It might be mentioned, in passing, that if the principle of nationality was to be loyally carried out, the heterogeneous Austro-Hungarian Empire would be completely divided up among its neighbors, Transylvania to Rumania, Austria, proper, to Germany, etc.

Consult the following list of articles for a history of the growth of national antagonisms since the beginning of the nineteenth century:

French Revolution	Cavour
Napoleon I	Mazzini
Peninsula War	Garibaldi
Tugenbund	Eastern Question
Vienna, Congress of	Russo-Turkish War
Alexander I (Russia)	Berlin, Congress of
Charles XIV John (Sweden)	Pan Slavism
Stewart, Robert (Second Marquis of Londonderry, Castlereagh)	Pan-Germanism (under War in Europe)
Wellington, A. W.	Africa
Hardenberg, K. A.	Turco-Italian War
Humboldt, K. W.	Balkan War
Metternich, C. W. N. L.	
Nesselrode, K. R.	
Stein, H. F. K.	
Talleyrand-Perigord, C. M.	
Crimean War	
Declaration of Paris	
Paris, Treaties of	
Seven Weeks' War	
Schleswig-Holstein	
Bismarck-Schönhausen, K. O. E. L.	
William I (Germany)	
William II (Germany)	
Franco-German War	
Alsace	
Lorraine	
Benedetti, Vincent	
Napoleon III	

In order to learn the part played by individual countries during the nineteenth and early twentieth centuries, as well as to find such important historical material bearing on national antagonisms as the unification of Italy (under ITALY), the Graeco-Turkish War of 1897 (under GREECE), etc. See the historical sections of the following:

Albania  
Austria-Hungary  
Belgium  
Bosnia  
Bulgaria  
Denmark

France  
 Germany  
 Greece  
 Herzegovina  
 Italy  
 Montenegro  
 Netherlands  
 Norway  
 Poland  
 Portugal  
 Rumania  
 Russia  
 Sardinia  
 Servia  
 Sicilies, Kingdom of the Two  
 Spain  
 Switzerland  
 Turkey  
 United Kingdom of Great Britain  
 and Ireland

For the biographies of statesmen, soldiers, etc., prominent during the war see the treatment of the countries involved in Chapter I of this volume. Supplementary to the lists given there are the additional biographical footnotes at the bottom of the pages of the War in Europe article.

## 2. MILITARISM.

Militarism, as defined in the NEW INTERNATIONAL ENCYCLOPEDIA, is "A term employed somewhat loosely to designate a tendency to subordinate civil to military considerations in the policy of the State." We find that all the powers of Europe illustrate this tendency to a greater or less degree. Each has watched any move by the other and attempted to meet any increase in armament by a similar increase. For example, when Germany increased her army in 1913, France passed a law changing the term of ser-

vice to 3 years, because her slowly increasing population would not permit an outright increase. To appreciate the modern tendency, consult the sections on ARMIES and NAVIES in the articles on the more important countries mentioned above and the following general subjects, which contain also many appropriate cross references:

Militarism  
 Armies  
 Navies  
 Military Education  
 Imperialism  
 Industrialism  
 Peace Movement, International

## 3. ECONOMIC RIVALRY.

For the economic causes of the war it is not necessary to go back further than the beginning of the nineteenth century. Then occurred the Industrial Revolution, which substituted the factory system of manufacture for the cottage system. It also introduced the problem of capital and labor. With the vast increase in production, it was only natural that European countries should look for a market for their goods commensurate with the output. England had a monopoly of manufactures for almost three quarters of a century. Then France, Germany, etc., felt the effects of the revolution and began to look for their "places in the sun." The chief form taken by this economic rivalry was colonization and preferential tariffs. Africa and Asia were partitioned, practically between France and England, thus leaving Germany with no desirable place of expansion. Germany maintained that the adoption of preferential tariffs by the British colonies were attempts to crip-

ple German trade. For history of colonization and the tariff systems see history of countries mentioned *supra* and the following articles:

Political Economy  
Industrial Revolution  
Factories and the Factory System  
International Trade  
Commerce  
Custom's Duties  
Free Trade  
Protection  
Tariff  
Mercantilism  
Reciprocity  
Taxation  
Imperialism  
Imperial Federation  
Industrialism  
Colony  
Canada  
Australia  
India  
New Zealand

Africa  
Union of South Africa  
Egypt  
Morocco  
Tripoli  
German East Africa  
German Southwest Africa  
Kamerun  
Togoland  
Algeria  
Angola  
French West Africa  
Upper Senegal and Niger  
Asia  
Persia  
Afghanistan  
Beluchistan  
China  
Manchuria  
Korea  
Eastern Question  
Far Eastern Question  
Open Door

## II. Military Operations

The military operations in the WAR IN EUROPE are treated under the following main divisions:

I. Introduction and Discussion of Mobilization.

II. Western Theatre, or Campaign against France.

III. Eastern Theatre, or Campaign against Russia.

IV. Southern Theatre or Serbian and Italian Campaigns.

V. Southeastern Theatre or Turkish Campaigns.

For technical subjects, see the chap-

ter on MILITARY AND NAVAL SCIENCE and the following special articles:

Armies (also section under each country)  
Mobilization  
Army Organization  
Artillery  
Cavalry  
Infantry  
Frontier, Military  
Militia  
Military Education  
Military Geography  
Tactics, Military  
Ammunition  
Ballistics

Engineering, Military  
Ordnance  
Fortification  
Battle

Articles which have had special treatment because of the war include the following:

(a) *Western Front:*

Ghent  
Havre  
Huy  
Kiel  
Knocke  
La Bassée  
La Fère  
Lens  
Liège  
Lierre  
Lille  
Longwy  
Lorraine  
Louvain  
Luxemburg  
Lys  
Maubeuge  
Meaux  
Mechlin  
Menin  
Metz  
Meurth-et-Moselle  
Meuse  
Mézières  
Mons  
Montmedy  
Moselle  
Namur  
Nancy  
Nieuport  
Nish  
Novogeorgievsk  
Ostend  
Paris  
Peronne

Piotrokov  
Plock  
Pont-A-Mousson  
Poperinghe  
Posen  
Rheims  
Roubaix  
Roulers  
Roye  
Saarburg  
Saint Dié  
Saint-Quentin  
Soissons  
Souchez  
Tirlemont  
Toule  
Tourcoing  
Valenciennes  
Verdun  
Verviers  
Ypres

(b) *Eastern Front:*

Galicja  
Graudenz  
Ivangorod  
Jaroslau  
Kalish  
Kielce  
Kolmar  
Kolo  
Königsberg  
Krasnick  
Lask  
Lemberg  
Lodz  
Lomza  
Lowicz  
Lublin  
Lyck  
Marienburg  
Marmaros-Szigét  
Masurenland  
Mlawa  
Ostrolenka



Pinsk  
 Poland  
 Przasnysz  
 Przemyśl  
 Rzeszów  
 Saint Petersburg  
 Sambor  
 Shavli  
 Siedlce  
 Silesia  
 Stanisław  
 Stryj  
 Suczawa  
 Suwalki  
 Tannenberg  
 Tarnopol  
 Tarnów  
 Thorn  
 Tilsit  
 Tomaszów  
 Transylvania  
 Vilna  
 Warsaw  
 Wieliczka

(c) *Southern Front:*

Mostar  
 Pirot  
 Pola

Pozarévatz  
 Prisrend  
 Roveredo  
 Saloniki  
 Scutari  
 Semendria  
 Senlis  
 Sarajevo  
 Shabatz  
 Tyrol  
 Udine  
 Uskop

(d) *Southeastern Front:*

Kars  
 Khopa  
 Suez Canal  
 Tabriz  
 Transcaucasia  
 Urumia  
 Van

(e) *Colonies:*

German East Africa  
 German Southwest Africa  
 Kiaochow  
 Tahiti  
 Union of South Africa  
 Windhoek

### III. Naval Operations

The naval operations during the Great War took place on almost every known sea. Engagements between fleets were comparatively scarce, until the great battle off Jutland. This engagement, with those off the coast of Chile and near the Falkland Islands, were the most important fleet activities. Outstanding features of the naval operations were the submarine warfare, the spectacular raids on merchantmen, the blockade of Germany and

the transportation of large numbers of troops from one place to another by the Allies. This section of the article is divided into the following divisions:

Operations in the North Sea and the Waters about Great Britain  
 Operations in the Baltic  
 Operations in the Mediterranean  
 Operations in the Black Sea and Dardanelles  
 Cruiser Operations in the Atlantic, Pacific and Indian Oceans

Naval Strategy of the War  
Some Naval Lessons of the War

For a complete list of the more important articles in the NEW INTERNATIONAL ENCYCLOPÆDIA dealing with naval science, see Chapter 30 in this volume. Some of this might well be mentioned here, together with titles brought into prominence by the war. See also section on *Navies* of the countries involved:

Navies  
Armor Plate  
Battleship  
Ship, Armored  
Torpedo Boat  
Signals, Marine  
Tactics, Naval  
Target Practice, Naval  
Naval Aëronautics  
Naval Reserve  
Naval Schools of Instruction

Naval Stores  
Hartlepool  
Helgoland  
Kaiserwilhelmsland  
Keeling Islands  
Kiaochow  
Kiel  
Libau  
Lissa  
Marshall Islands  
Memel  
New Guinea  
Odessa  
Ragusa  
Reval  
Samoan Islands  
Scarborough  
Sebastopol  
Solomon Islands  
Togoland  
Trebizond  
Varna  
Yarmouth

## IV. Aerial Operations

For the first time in history, aerial operations played an important rôle in warfare. The aerial section of the Great War articles tells the different use to which the different types of aircraft were put. Consult Chapter 17 in this volume dealing with AËRONAUTICS. See:

Aëronautics  
Navigation, Aërial, Law of  
Military Aëronautics

Naval Aëronautics  
Hangar  
London  
Luneville  
Paris  
Saarbrücken  
Sandringham  
Treves  
Trieste  
Venice  
Verona

## V. Neutral Nations

As the war developed it became almost as difficult for a neutral to maintain an attitude of strict neutrality as it was to be a belligerent. The trade

markets of the world were completely upset and all routes and methods of transportation changed entirely. Commerce carrying vessels of the bel-

ligerents were requisitioned for war purposes, and in many neutral countries also political, as well as economical, disturbances resulted. The destruction of neutral vessels, the seizure of neutral mails, etc., brought forth protests from many neutral nations. Besides the historical sections of the neutral nations, such as the United

States, Norway, Sweden, the Netherlands, see:

International Law  
Neutrality  
Armed Neutrality  
Blockade  
Contraband of War  
Declaration of Paris  
London, Declaration of

## *VI. Financial and Economic Aspects*

The problem of financing the Great War proved to be extremely difficult. With trade and industry all but at a standstill, the usual channels for borrowing money were closed. War taxes of all descriptions were levied and old taxes were greatly increased. Large loans were sought at home and abroad. A large joint loan floated in the United States by the Entente Allies was followed by various national loans secured by undoubted collateral, as well as by the resources of the respective governments. The following list includes the more important ar-

ticles which deal with financing a war:

Tax  
Moratorium  
Credit  
Rediscounting  
Stock Exchange  
Bonds  
Stocks  
Panic, Financial  
Crisis, Economic  
Money  
Marine Insurance  
Bank, Banking  
Foreign Money

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## Chapter 32. Medicine

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**T**HE dissemination of some medical knowledge among the laity is a matter of inestimable social importance. Popular ignorance on the subjects of hygiene, the prevention of disease, and the care of the sick, places many widespread evils sadly beyond the power of the medical profession. The average man's failure, moreover, to appreciate clearly the soundness of the principles and methods of medical science invites the appearance in the community of various mystical, or mystifying, quacks, claiming to know therapeutic methods of all but miraculous efficiency, and offering to sell medicines which, like the philosopher's stone once vainly sought by the alchemists, possess unlimited curative powers. Honest and valuable knowledge to-day has no secrets, and, notwithstanding, or rather because of, really considerable development, is professedly aware of its limitations. Perhaps, therefore, the clearest mark of the impostor or incompetent is the alleged possession of secrets or of methods of universal applicability. Nor will the cunning theories, widely advertised in support of such allegations, appear at all reasonable to the man who has familiarized himself with the main principles and facts of scientific—that is, rational—medicine.

The lists of articles presented in the following pages map out a complete course of systematic reading in medicine. A true understanding of the purely medical subjects, even in their elementary aspects, is possible only after the acquisition of some knowledge of the general biological sciences and of chemistry. Thus, human anatomy is best understood if studied in connection with comparative anatomy. Physiology is more or less obscure if studied without a preliminary knowledge of the general principles of chemistry and biology, and, again, human physiology should be studied in connection with the physiology of the lower animals. Even general botany presents a number of points of the highest interest to the student of human anatomy and physiology. Should the assiduous reader of the *Encyclopædia* desire to familiarize himself with these and cognate subjects, the present volume will readily afford the necessary guidance. We would especially call attention to the psychological articles on the special senses and faculties, without which the physiological functions of the brain and nervous system cannot be thoroughly understood. Further, a large number of chemico-physiological articles on special foods, and of articles on subjects of veterinary medicine, will be found listed in the chapter Agriculture, Horticulture, and Forestry, those articles having been prepared for the *Encyclopædia* by the food and veterinary experts of the United States Department of Agriculture.

The classification of the medical subjects proper, on which the lists below are based, and the order of sequence of the subjects in the lists themselves, are those adopted by the best medical authorities, with slight modifications to suit the distribution of subject-matter in the *Encyclopædia*. The only considerable deviations from general usage are in the case of anatomy and physiology, the two being somewhat closely interwoven in the *Encyclopædia* and therefore, here, too, arranged as one joint subject. The listed articles comprise a complete

treatment of essentials. The reader desiring more detailed information on particular bones, muscles, nerves, etc., will be guided to the special articles on such subjects by cross-references in the articles listed.

The only lists in which the order of sequence of the topics is not according to some recognized system are those under "Symptoms and Morbid Conditions" (division, Pathology and Therapeutics) and "Diseases of the Skin" (division, Diseases of the Nose and Throat, Ear, Eye, Skin, and the Genito-Urinary System). The former list comprises those symptoms and morbid conditions that are common to more than one class of diseases and that could not, therefore, be included in the somewhat rigidly classified lists preceding. On the other hand, the orders of sequence of skin diseases usually adopted in special medical works are practically useless. It was, therefore, deemed best in both cases to preserve the alphabetical order—for convenience of reference. The list of "Drugs" (division, Materia Medica) includes all the pharmacopœial preparations in frequent use. A number of rarer drugs may be found described in the articles on chemical subjects.

The biographies of famous medical men are arranged in the order of historical sequence and, together with the articles listed under "History," form a complete presentation of the history of medicine—a truly fascinating subject. Interesting historical detail will also be found in the articles on all medical topics of any importance. The inclusion of such historical articles as BATH, BARBER, EMPIRIC, DERIVATION, BLACK DEATH, PLAGUE, INOCULATION, etc., would have swelled the lists unnecessarily.

## 1. INTRODUCTORY ARTICLES.

Medical Education  
Homœopathy  
Eclectic School of Medicine  
Nurses, Training of  
Clinic  
Hospital  
Dispensary  
Ambulance  
Insane Asylum  
Bedlam  
Gheel  
Epileptic Colony  
Vital Statistics  
Sanitary Laws  
Health, Boards of  
Contagious Diseases  
Hippocratic Oath  
Medical Code

Malpractice  
Medicine

## II. ANATOMY AND PHYSIOLOGY.

### 1. *General Articles:*

Anatomy  
Physiology

### 2. *Bones, Muscles, and Ligaments:*

Bone  
Cartilage  
Marrow  
Periosteum  
Suture  
Ossification  
Skeleton  
Skull  
Spinal Column  
Rib  
Sternum

Muscle and Muscular Tissue

Tendon

Ligament

Flesh

Muscular Force

Diaphragm

Joint

Shoulder-Joint

Arm

Hand

Hip-Joint

Thigh

Knee-Joint

Patella

Leg

Foot

**3. Cavities:**

Skull

Chest

Abdomen

Pelvis

**4. Nervous System and Brain:**

Nervous System and Brain

Cerebro-Spinal Fluid

Inhibition

**5. Circulatory System:**

Circulation

Heart

Vein

Artery

Pulse

Aorta

Innominate Artery

Carotid Artery

Iliac Arteries

Blood

Blushing

**6. Respiratory System:**

Respiration, Organs and Process of

Pharynx

Larynx

Voice

Trachea

Bronchus

Asphyxia

**7. Alimentary System:**

Alimentary System

Digestion, Organs and Processes of

Food

Nutrition

Teeth

Pharynx

Salivary Gland

Œsophagus

Stomach

Pepsin

Intestine

Peristaltic Motion

Pancreas

Pancreatin

Liver

Bile

Brunner's Glands

Absorption

Colon

Cæcum

Vermiform Appendix

Rectum

Anus

Fæces

**8. Genito-Urinary System.**

Puberty

Menstruation

Climacteric Year

Reproduction

Ovary

Fallopian Tubes

Uterus

Vagina

Bartholin's Glands

Breast

Kidney

Ureter

Bladder

Urethra

Urine

9. *Special Senses:*

Nose

Eye

Ear

Tongue

Touch

10. *Ductless Glands and Lymphatic Structures:*

Thyroid Gland

Thymus Gland

Suprarenal Capsules

Pituitary Body

Spleen

Tonsil

Lymphatic

Thoracic Duct

Lacteal

Chyle

Lymph

11. *Tissues:*

Histology

Epithelium

Gland

Skin

Hair

Sweat

Nail

Scalp

Membrane

Mucous Membrane

Connective Tissue

Adipose Tissue

Endothelium

Serous Membrane

Pericardium

Pleura

Mesentery

Peritoneum

Periosteum

Muscle and Muscular Tissue

Nervous System and Brain

12. *Embryology:*

Embryology, Human

Epigenesis

Embryo

Fœtus

13. *Physiological Subjects not included Above:*

Chemistry, Physiological

Life, Mean Duration of

Rigor Mortis

Longevity

Metabolism

Animal Heat

Temperature of the Body

Sleep

Hypnoscope

Sex

Sensation

Secretion

Vivisection

Vegetarianism

III. *HYGIENE AND PROPHYLACTIC METHODS.*

Hygiene

Sanitary Laws

Sanitary Science

Health

Immunity

Quarantine

Disinfectants

Heating and Ventilation

Water Supply

Water Purification

Sewage Disposal

Food

Diet

Infants, Feeding of

Wine

Sterilized Food

Exercise

Physical Training

Bath

Vaccination

**IV. PATHOLOGY AND THERAPEUTICS.**

**1. *General Articles:***

Pathology  
Therapeutics  
Disease  
Nosology  
Disease, Germ Theory of  
Distribution of Diseases  
Congenital Disease  
Degeneration  
Intermarriage  
Filth Disease  
Occupational Diseases  
Endemic  
Epidemic  
Infection  
Insects, Propagation of Disease  
by  
Bacteria  
Microscopy, Clinical  
Toxin  
Virus  
Homœopathy  
Eclectic School of Medicine  
Christian Science  
Osteopathy  
Leeching

**2. *Specific Infectious Diseases:***

Typhoid Fever  
Relapsing Fever  
Smallpox  
Chicken Pox  
Scarlet Fever  
Measles  
Mumps  
Whooping Cough  
Influenza  
Dengué  
Meningitis  
Erysipelas  
Diphtheria  
Croup  
Septicæmia

Poliomyelitis

Cholera

Yellow Fever

Black Vomit

Plague

Dysentery

Malaria and Malarial Fever

Ague

Jungle Fever

Malignant Pustule

Anthrax

Intermittent Fever

Remittent Fever

Hydrophobia

Tetanus

Trismus Nascentium

Syphilis

Tuberculosis

Scrofula

Glanders

Actinomycosis

Febricula

Malta Fever

**3. *Constitutional Diseases:***

Rheumatism

Lumbago

Gout

Diabetes

Rickets

Scurvy

Purpura

Hæmophilia

Obesity

**4. *Diseases of the Alimentary System:***

Mouth, Diseases of the

Aphthæ

Pharyngitis

Quinsy

Œsophagus

Stomach, Diseases of the

Gastritis

Dyspepsia



Indigestion

Enteritis

Gastro-Enteritis

Cholera Infantum

Mesentery

Liver, Diseases of the

**5. *Diseases of the Respiratory System:***

Rhinitis

Hay Fever

Laryngitis

Bronchitis

Asthma

Tuberculosis

Pneumonia

Pleurisy

Hydrothorax

**6. *Diseases of the Circulatory System:***

Heart, Diseases of the

Pericarditis

Endocarditis

Myocarditis

Palpitation

Angina Pectoris

Atheroma

Arterio-Sclerosis

**7. *Diseases of the Blood and Ductless Glands:***

Anæmia

Chlorosis

Leucocythæmia

Goitre

Cretinism

Myxædema

Basedow's Disease

Acromegaly

Addison's Disease

**8. *Diseases of the Kidneys:***

Kidney, Diseases of the

Bright's Disease

Uræmia

**9. *Diseases of the Nervous System and Brain:***

Neurology

Nervous Disease

Nervousness

Paralysis

Neuritis

Sciatica

Facial Paralysis

Caisson Disease

Myelitis

Locomotor Ataxia

Syringomyelia

Brain, Diseases of the

Aphasia

Apoplexy

Hemiplegia

Hydrocephalus

Paralysis Agitans

Chorea

Epilepsy

Hystero-Epilepsy

Migraine

Neuralgia

Facial Neuralgia

Neurosis

Hysteria

Sea-Sickness

Neurasthenia

Hypochondriasis

Rest-Cure

Acromegaly

Stammering

Nostalgia

Fatuity

Imbecility

Idiocy

Insanity

Delirium

Dipsomania

Melancholia

Mania

Paranoia

Pellagra

Monomania  
 Pyromania  
 Kleptomania  
 Homicidal Mania  
 Puerperal Insanity  
 Paresis  
 Lucid Interval  
 Imitative Insanity

10. *Parasitic Diseases:*

Parasitic Diseases  
 Worms  
 Oxyuris  
 Trichiniasis  
 Sleeping-Sickness  
 Filaria  
 Lumbricoid  
 Tapeworm

11. *Symptoms and Morbid Conditions:*

Albuminuria  
 Amblyopia  
 Amenorrhœa  
 Anosmia  
 Aphonia  
 Arcus Senilis  
 Asthenopia  
 Bedsores  
 Breath, Offensive  
 Cachexia  
 Catalepsy  
 Catarrh  
 Colic  
 Coma  
 Congestion  
 Constipation  
 Convulsion  
 Coughing  
 Cramp  
 Crisis  
 Cyanosis  
 Degeneration  
 Diarrhœa  
 Dropsy

Ecchymosis  
 Embolism  
 Epistaxis  
 Fainting  
 Fatty Degeneration  
 Fever  
 Formication  
 Hæmaturia  
 Hæmoptysis  
 Headache  
 Heat-Stroke  
 Hectic Fever  
 Hemiopia  
 Hiccough  
 Hyperæsthesia  
 Hypertrophy  
 Insomnia  
 Jaundice  
 Knee-Jerk  
 Leucorrhœa  
 Locomotor Ataxia  
 Muscæ Volitantes  
 Nausea  
 Œdema  
 Osteomalacia  
 Oxaluria  
 Papule  
 Pectoriloquy  
 Petechia  
 Pleurodynia  
 Polydipsia  
 Pulse  
 Purpura  
 Pyrosis  
 Respiratory Sounds  
 Senility  
 Sitophobia  
 Skin Disease  
 Spasm  
 Starvation  
 Sweat  
 Symptom  
 Tenesmus  
 Thirst

Tinnitus Aurium  
 Urine, Incontinence of  
 Vertigo  
 Vomiting  
 Waxy, or Amyloid Degeneration

12. *Diagnostic and Therapeutic  
 Methods and Instruments:*

Diagnosis  
 Percussion  
 Auscultation  
 Stethoscope  
 Dynamometer  
 Axillary Thermometer  
 Temperature of the Body  
 X-Rays  
 Microscopy, Clinical  
 Laryngoscope  
 Ophthalmoscope  
 Therapeutics  
 Diet  
 Exercise  
 Movement Cure  
 Hydrotherapy  
 Massage  
 Rest-Cure  
 Transfusion of Blood  
 Venesection  
 Radium

V. SURGERY, GYNÆCOLOGY, AND OB-  
 STETRICS.

1. *General Articles:*

Surgery  
 Surgery, Military  
 Obstetrics

2. *General Surgical Pathology:*

Inflammation  
 Suppuration  
 Pus  
 Abscess  
 Boil  
 Felon  
 Carbuncle  
 Ulcer

Phagedena  
 Sinus  
 Fistula  
 Necrosis  
 Gangrene  
 Caries  
 Adhesion  
 Cicatrization  
 Bruise  
 Wound  
 Gunshot Wound  
 Dissection Wounds  
 Burns and Scalds  
 Frostbite  
 Tumor  
 Cyst  
 Hydatid  
 Actinomycosis  
 Adenitis  
 Septicæmia  
 Pyæmia  
 Shock

3. *General Surgical Technique:*

Anæsthesia  
 Antiseptic  
 Acupressure  
 Acupuncture  
 Bleeding  
 Drainage Tubes  
 Ligature  
 Suture  
 Tourniquet  
 Puerperal Fever  
 Abortion  
 Forceps  
 Embryotomy  
 Cæsarean, or Cæsarian, Opera-  
 tion  
 Leeching  
 Electricity, Medical Uses of  
 Compressed-Air Treatment  
 Respiration, Artificial  
 Resuscitation  
 Stomach-Pump  
 Cupping

Organotherapy  
Serum Therapy  
Antitoxin  
Tuberculin  
Hypnotism  
Hypodermic Medication

4. *Pathology of Special Structures:*

Artery  
Aneurism  
Phlebitis  
Varicose Vein  
Thrombosis  
Embolism  
Nerve-Stretching  
Fracture  
Callus  
Osteomyelitis  
Periostitis  
Splint  
Amputation  
Sprain  
Synovitis  
Arthritis  
Housemaid's Knee  
Ankylosis  
Dislocation  
Resection  
Wen  
Keloid  
Chapped Hands  
Bunion  
Corn  
Skin-Grafting

5. *Orthopædic Surgery:*

Deformities  
Wry-Neck  
Pott's Disease  
Spine, Curvature of the  
Hip-Joint  
Knock-Knee  
Leg  
Valgus  
Varus  
Clubfoot

Tenotomy  
Artificial Limbs

6. *Regional Surgery, Including Gynæcology:*

Encephalocele  
Concussion of the Brain  
Trepine, Trephining  
Rhinoplastic Operation  
Harelip  
Ranula  
Dentistry  
Laryngotomy  
Tracheotomy  
Choking  
Mammary Gland, Diseases of  
Rib, Fracture of the  
Pleurisy  
Empyema  
Peritonitis  
Gastrostomy  
Umbilical Hernia  
Hernia  
Truss  
Intussusception  
Laparotomy  
Vermiform Appendix  
Perityphlitis  
Ovary  
Nephrotomy  
Nephrectomy  
Calculus, or Stone  
Lithotrity  
Lithotomy  
Castration  
Rectum, Diseases of the  
Prolapsus Ani  
Piles  
Spina Bifida  
Uterus, Diseases of the  
Prolapsus Uteri  
7. *Obstetrics:*  
Obstetrics  
Gestation  
Superfœtation and Superfecundation

Placenta  
Puerperal Fever  
Caul  
Umbilical Cord  
Meconium  
Weaning  
Agalactia

VI. DISEASES OF THE NOSE AND  
THROAT, EAR, EYE, SKIN, AND  
THE GENITO-URINARY SYS-  
TEM.

1. *Diseases of the Nose and Throat:*

Rhinitis  
Epistaxis  
Ozena  
Polypus  
Throat, Affections of the  
Larynx, Diseases of the  
Laryngitis

2. *Diseases of the Ear:*

Ear  
Deafness  
Cerumen  
Otitis Media  
Otorrhœa  
Otalgia

3. *Diseases of the Eye:*

Eye, Diseases of the  
Blindness  
Ectropion  
Entropion  
Stye  
Trichiasis  
Conjunctivitis  
Ophthalmia  
Blepharitis  
Cornea  
Leucoma  
Staphyloma  
Iritis  
Glaucoma  
Cataract  
Retinitis  
Nyctalopia

Color-Blindness  
Optic Neuritis  
Sight, Defects of  
Myopia  
Hyperopia  
Astigmatism  
Heterophoria  
Strabismus

4. *Diseases of the Skin:*

Acarus Folliculorum  
Acne  
Alopecia  
Bromidrosis  
Corn  
Ecthyma  
Eczema  
Erythema  
Favus  
Hair  
Ichthyosis  
Impetigo  
Itch  
Leprosy  
Lichen  
Lupus  
Nævus  
Pemphigus  
Pityriasis  
Plica  
Prurigo  
Psoriasis  
Ringworm  
Rupia  
Seborrhœa  
Sycosis  
Tinea  
Vitiligo  
Wart  
Yaws

5. *Diseases of the Genito-Urinary  
System:*

Cystitis  
Calculus, or Stone  
Extravasation

Prostate Gland  
 Gonorrhœa  
 Stricture  
 Hydrocele  
 Varicocele  
 Syphilis  
 Circumcision

VII. MATERIA MEDICA.

1. *General Articles:*

Materia Medica  
 Pharmacopœia  
 Toxicology  
 Prescription

2. *Preparation of Drugs:*

Tincture  
 Pill  
 Liniment  
 Lotion  
 Plasters  
 Infusion  
 Extract  
 Percolation  
 Suppository  
 Unguent  
 Ointment  
 Elixir

3. *Classification of Drugs:*

Alterative  
 Tonic  
 Excitant  
 Narcotics  
 Sedatives  
 Hypnotics  
 Anæsthetic  
 Anodyne  
 Antipyretic  
 Febrifuge  
 Expectorant  
 Stimulants  
 Gargle  
 Emetics  
 Anti-Emetic  
 Bitters

Antacids  
 Carminatives  
 Cholagogue  
 Laxative  
 Purgatives  
 Cathartic  
 Hydragogues  
 Anthelmintic  
 Diuretics  
 Diaphoretics  
 Anhidrotics  
 Antispasmodic  
 Astringents  
 Demulcents  
 Diluents  
 Aphrodisiac  
 Anaphrodisiacs  
 Emmenagogues  
 Oxytocics  
 Irritant  
 Rubefacients  
 Refrigerants  
 Depilatories  
 Disinfectants  
 Poison  
 Antidote

4. *Drugs:*

Quinine  
 Mercury, Medicinal uses of  
 Iodine  
 Iodides  
 Bromides  
 Arsenic  
 Iron  
 Colchicum  
 Colchicine  
 Salicylic Acid  
 Salicylates, Medical Uses of the  
 Salicin  
 Sulphur, Medical Uses of  
 Fern, Male  
 Kamala  
 Santonin  
 Goa Powder

Chrysarobin  
 Phosphorus  
 Alcohol, Pharmacology, Toxicology, and Therapeutic Use  
 Absinthe  
 Hashish  
 Opium  
 Laudanum  
 Paregoric  
 Dover's Powder  
 Morphine  
 Chloral  
 Paraldehyde  
 Hypnal  
 Sulphonal  
 Trional  
 Urethane  
 Hemlock  
 Coniine  
 Curari  
 Chloroform  
 Ether, or Di-Ethyl-Ether  
 Nitrous Oxide  
 Cocaine  
 Digitalis  
 Nux Vomica  
 Strychnine  
 Strophanthus  
 Valerian  
 Sparteine  
 Aconite  
 Hellebore  
 Veratrine  
 Tobacco  
 Amyl Nitrite  
 Nitroglycerin  
 Belladonna  
 Atropine  
 Homatropine  
 Sal Ammoniac  
 Heroin  
 Guaiacol  
 Creosotol  
 Calumba

Sodium  
 Lime, or Calcium Oxide  
 Apomorphine  
 Asafœtida  
 Senna  
 Cascara Sagrada  
 Castor Oil  
 Blue Pill  
 Calomel  
 Rhubarb  
 Aloes  
 Seidlitz Powders  
 Rochelle Salt  
 Epsom Salt  
 Jalap  
 Colocynth  
 Elaterin  
 Bismuth  
 Lead  
 Lunar Caustic  
 Diuretin  
 Copaiba  
 Methylene Blue  
 Salol  
 Jaborandi  
 Iodoform  
 Carbolic Acid  
 Sulphurous Acid  
 Antipyrine  
 Phenacetine  
 Acetanilid  
 Matzoon  
 Cod-Liver Oil  
 Lanolin  
 Ichthyol  
 Salvarsan

## VIII. HISTORY AND BIOGRAPHY.

### 1. *History:*

Medicine  
 Homœopathy  
 Eclectic School of Medicine  
 Anatomy  
 Histology

Physiology  
Hygiene  
Pathology  
Disease, Germ Theory of  
Therapeutics  
Surgery  
Surgery, Military  
Obstetrics  
Dentistry

2. *Biography:*

Hippocrates  
Galen, or Claudius Galenus  
Aretæus  
Avicenna  
Linacre, or Lynaker, Thomas  
Paracelsus  
Fracastoro, Girolamo  
Fallopio, or Fallopius, Gabriel  
Vesalius, Andreas  
Eustachio, Bartolommeo  
Paré, Ambroise  
Fabricius, or Fabrizio, Girolamo  
Harvey, William  
Sydenham, Thomas  
Pecquet, Jean  
Graaf, Regnier de  
Willis, Thomas  
Malpighi, Marcello  
Radcliffe, John  
Leeuwenhoek, Antonius van  
Boerhaave, Hermann  
Hoffmann, Friedrich  
Sloane, Sir Hans  
Morgagni, Giovanni Battista  
Swieten, Gerard van  
Haller, Albrecht von  
Pott, Percival  
Brown, John  
Cullen, William  
Hunter, John  
Perkins, Elisha  
Auenbrugger, von, or Auen-  
brugg, Leopold

Mesmer, Franz, or Friedrich-  
Anton  
Bell, John  
Jenner, Edward  
Baillie, Matthew  
Pinel, Philippe  
Post, Wright  
Gall, Franz Joseph  
Soemmering, Samuel Thomas  
von  
Scarpa, Antonio  
Spurzheim, Johann Kaspar  
Hufeland, Christoph Wilhelm  
Physick, Philip Syng  
Broussais, François Joseph  
Victor  
Ling, Pehr Henrik  
Esquirol, Jean Etienne Domi-  
nique  
Cooper, Sir Astley Paston  
Larrey, Dominique Jean  
Bell, Sir Charles  
Hahnemann, Samuel  
Dieffenbach, Johann Friedrich  
Wells, Horace  
Morton, Samuel George  
Priessnitz, Vincenz  
Beaumont, William  
Orfila, Matthieu Joseph Bona-  
venture  
Graves, Robert James  
Ennemoser, Joseph  
Magendie, François  
Warren, John Collins  
Amussat, Jean Zuléma  
Hall, Marshall  
Bright, Richard  
Müller, Johannes  
Forbes, Sir John  
Francis, John Wakefield  
Wagner, Rudolph  
Mott, Valentine  
Quain, Jones  
Lawrence, Sir William



- Flourens, Marie Jean Pierre  
Goodsir, John  
Morton, William Thomas Green  
Syme, James  
Simpson, Sir James Young  
Parrish, Edward  
Holland, Sir Henry  
Winslow, Forbes (Benignus)  
Andral, Gabriel  
Rokitansky, Karl, Baron  
Bernard, Claude  
Peaslee, Edmund Randolph  
Long, Crawford W.  
Wood, George Bacon  
Taylor, Alfred Swaine  
Seguin, Edouard Onesimus  
Broca, Paul  
Sims, James Marion  
Parker, Willard  
Gross, Samuel D.  
Draper, John Christopher  
Post, Alfred Charles  
Flint, Austin  
Kneeland, Samuel  
Gray, John Perdue  
Quain, Richard  
Langenbeck, Bernhard Rudolph  
von  
Parker, Peter  
Bright, Richard  
Ricord, Philippe  
Taylor, Isaac Ebenezer  
Owen, Sir Richard  
Earle, Pliny  
Mackenzie, Sir Morell  
Peters, John Charles  
Moleschott, Jacob  
Charcot, Jean Martin  
Brown-Sequard, Charles Edouard  
Pasteur, Louis  
Tuke, Daniel Hack  
Loomis, Alfred Lee  
Dubois-Reymond, Emil Heinrich  
Kneipp, Sebastian  
Lusk, William Thompson  
Quain, Sir Richard  
Hart, Ernest Abraham  
Pepper, William  
Seguin, Edward Constant  
Paget, Sir James  
Taylor, Charles Fayette  
Hammond, William Alexander  
Virchow, Rudolph  
Kussmaul, Adolph  
Thomas, Theodore Gaillard  
Davis, Nathan Smith  
Thompson, Sir Henry  
Esmarch, Johannes Friedrich  
August von  
Guernsey, Egbert  
Lister, Sir Joseph  
Emmet, Thomas Addis  
Mitchell, Silas Weir  
Jacobi, Abraham  
Turner, Sir William  
Recklinghausen, Friedrich von  
Flint, Austin, Jr.  
Smith, Andrew Heermance  
Sternberg, George Miller  
Carpenter, William Benjamin  
Hansen, Gerard Henrik Armauer  
Janeway, Edward Gamaliel  
King, Albert Freeman Africanus  
Wood, Horatio Curtis  
Rayleigh, John William Strutt,  
Baron  
Koch, Robert  
Laveran, Charles Louis Alphonse  
Morton, William James  
McBurney, Charles  
Trudeau, Edward Livingston  
Morselli, Enrico Agostino  
Spitzka, Edward Charles  
Lorenz, Adolph  
Starr, Moses Allen  
Horsley, Victor Alexander Haden  
Peterson, Frederick  
Manson, Patrick

Flexner, Simon  
Ehrlich, Paul  
Wassermann, August von  
Carrel, A.  
Sullstrand, Allvar  
Tiedemann, Friedrich  
Mayo, Charles Horace  
Mayo, William James

Richet, C. R.  
Kossel, Albrecht  
Behring, E. A. von  
Ross, Sir R.  
Metchnikoff, E.  
Ramón y Cajal, S.  
Pavlov, I. P.  
Finsen, N. R.

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# Chapter 33. Manners and Customs

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## Dress and Apparel

**N**OWHERE more than in the apparel of men and women does time wreak its changes and the spirit of an age stand out. The student of the manners and customs of a people or period often may apply himself with profit to a consideration of their garments, and conversely in a study of the garments reflex actions on the wearer may be observed. Indeed, clothes may be subject to the dictates of a fickle fashion or possess a spiritual and deep-lying significance, as in the case of ecclesiastical vestments, or changing from the decorative to the more serviceable, as in the case of the military or naval uniform.

Thus costume in itself may possess a significance more than merely for the interest of the votary of fashion. For such a student a series of articles might be recommended embraced in the following list:

Costume  
Dress  
Textiles  
Dress Reform  
Armor  
Fashion  
Embroidery  
Corset  
Crinoline  
Girdle  
Glove  
Hosiery  
Mantle  
Shawl  
Hair Dressing

Beard  
Cosmetics  
Rouge  
Perfumery  
Wig  
Hat  
Headdress  
Shoes  
Boots  
Jewelry  
Parasol  
Uniforms, Military and Naval  
Costume, Ecclesiastical  
Degree (for Academic Costume)

## Jewelry

Among the minor arts in none have there been more important developments than in the artistic design and fabrication of jewelry. In many fields there may be considered to have taken place within recent years a return to the artistic products of the early gold- and silver-smiths of Continental Europe, while in the cutting and setting of

gems there has also been opportunity for the display of the skill of the lapidary and the jeweler, who have evolved new styles of cutting and forms of settings.

Under the broad heading of **JEWELRY** in this section can be considered the articles for personal adornment, involving the use of precious and semi-

precious stones and the careful working of such metals as gold and silver, and also the manufacture of objects of utility and ornament of a somewhat larger description, such as tableware and the artistically decorated porcelain and other objects of art.

The visitor to a museum of fine arts would often find grouped in a single department such articles as are embraced in the following list, which is submitted for the guidance of the reader:

- Jewelry
- Fan
- Enamel
- Embossing
- Gems
- Goldsmith Work
- Inlaying
- Lacquer Work
- Lapidary Work
- Japanese Art
- Marquetry
- Metal Work
- Pearl
- Plate
- Porcelain
- Pottery
- Plated Ware
- Repousée
- Ring
- Stained Glass
- Table Ware
- Tarsia Work
- Fork
- Cutlery

In connection with jewelry, it is desirable to refer also to the various gems which are used for personal adornment. The article GEMS, which discusses the general qualities of precious or beautiful stones, with partic-

ular reference to those cut or engraved for use as jewels or seals, describes the history of such ornaments from the earliest periods of Egypt. This is followed by an article on GEMS, IMITATION AND ARTIFICIAL, in which are discussed the various imitations ranging all the way from crude affairs of glass to modern triumphs of the chemist, involving the electric furnace as a means of producing the gems artificially or synthetically.

While precious stones used for gems may have considerable value, due to their rare occurrence in nature, it is the lapidary who, in his cutting, grinding and polishing the various crystals or other precious stones, adds to their value or even, in some cases, gives beauty and value to stones whose intrinsic value is but small. Accordingly, the article LAPIDARY WORK should be read in addition to that on gems, and then the reader can take up the series of articles on the precious stones themselves—naturally headed by the diamond. These arrange themselves into two groups—those of great rarity and value, as follows:

- Diamond
- Emerald
- Ruby
- Sapphire
- Amethyst
- Opal
- Carnelian
- Turquoise
- Topaz

The second group comprises many, mostly crystalline minerals, that are also considered as precious, but whose rarity is not such as to put them in

the same class with the list just given.

Such minor stones would be:

' Corundum  
Quartz  
Beryl  
Chrysoberyl  
Aquamarine  
Tourmaline  
Alabaster  
Chalcedony

Sardonyx  
Argonite  
Agate  
Jasper  
Chrysolite  
Garnet  
Rhodonite  
Chrysocolla  
Catlinite

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# Chapter 34. Games and Sports

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**A**LL peoples indulge in exercises of strength, of skill, of bodily and mental agility, or of fortune, and often these mimic the more serious pursuits of life, or consist in these very pursuits indulged in for pleasurable purposes only.

1. The capture and slaying of animals has remained a source of pleasure long after it has ceased to be the chief business of life. See:

- (a) Shooting
  - Archery
  - Trapping
  - Coursing
  - Battue
  - Tiger-hunting
  - Still-Hunting
  - Fox-hunting
  - Falconry
  - Game Laws
  - Game Preserves
- (b) Angling
  - Bait-fishing
  - Salmon-fishing
  - Trolling
  - Trout-fishing
  - Fly-Casting

2. The mimicry of war is also found in contests between men or animals, or men and animals. See:

- Pugilism
- Boxing
- Wrestling
- Fencing
- Cock-fighting
- Bear-baiting
- Bull-fight

3. Water, both in its common state and in the forms of ice and snow, furnishes many forms of sport to primitive and civilized man. See:

- (a) Swimming
- Rowing

Canoe and Canoeing

Yachting

Water Polo

(b) Skating

Ice Polo

Ice Yachting

Curling

(c) Snowshoeing

Skiing

4. Useful to man in labors, the horse is his great companion in numerous sports. See:

Horsemanship

Coaching

Driving

Trotting

Pacing

Horse-racing

Stud-book

Derby Day

Steeple chasing

Polo

Hippodrome

5. Of the instruments entering into popular games, the ball, in various shapes, is by far the most common and the most widespread. See:

Bowls

Baseball

Indoor Baseball

Cricket

Golf

Croquet

Hockey

La Crosse

Polo

Football

Basketball

Handball

Pelota

Racquets

Tennis

Lawn Tennis

Court Tennis

Ping-Pong

Billiards

Bagatelle

6. In games of chance, the card and the die in varying forms are universally found. In the case of cards, however, chance often plays the minor part and the game assumes a highly intellectual character. See:

## (a) Cards

Whist

Bridge

Pinochle

Skat

Ecarté

Piquet

Bezique

Cribbage

Euchre

Solitaire

Poker

Baccarat

Rouge et Noir

Fan-tan

## (b) Dice

Hazard

Craps

## (c) Roulette

7. For the great intellectual games par excellence, see:

Chess

Checkers

and for cognate games:

Backgammon

Dominoes

## 8. Miscellaneous sports and games:

Cycling

Mountain Climbing

Coasting

Toboggan

Shuffleboard

Quoits

9. The general subject is treated under:

Athletics

Gymnastics

Physical Culture

Amateur

Handicapping

Sports, Book of

Games, Ancient

Gymkhana

Olympic Games

Pythian Games

Nemea

Gladiator

Circus

Acrobat









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